RANGE CONDITION ASSESSMENT REPORT

FOR

NAVAL SURFACE WARFARE CENTER, DAHLGREN LABORATORY RANGES

DAHLGREN, VIRGINIA

SEPTEMBER 2010

NSWCDD-AP-12-00275

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
SEP 2010		**00-00-2010 to 00-00-2010**

4. TITLE AND SUBTITLE	
Range Condition Assessment Report for Naval Surface Warfare Center, Dahlgren Laboratory Ranges	5a. CONTRACT NUMBER
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Science Applications International Corporation,11251 Roger Bacon Drive,Reston,VA,20190**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**374**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

THIS PAGE WAS INTENTIONALLY LEFT BLANK

RANGE CONDITION ASSESSMENT REPORT

FOR

NAVAL SURFACE WARFARE CENTER, DAHLGREN LABORATORY RANGES

SEPTEMBER 2010

Original Document prepared by:

Science Applications International Corporation
11251 Roger Bacon Drive
Reston, Virginia 20190
Contract No.: FA 4890-04-D-0004

Please contact the following with comments and questions:
Commander, Attn: Code C6
Naval Surface Warfare Center, Dahlgren Division
6149 Welsh Road, Suite 239
Dahlgren, VA 22448-5117
E-mail: DLGR_NSWC_C6@navy.mil

NSWCDD-AP-12-00275

THIS PAGE WAS INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

Page

1. EXECUTIVE SUMMARY 1-1
   1.1 Review of Phase I – Range Selection 1-4
   1.2 Review of Phase II – Pre-Site Visit Information 1-4
   1.3 Review of Phase III – On-Site Visit Information 1-5
      1.3.1 RCA Environmental Compliance 1-5
      1.3.2 Overview of Operational Range Site Models 1-6
      1.3.3 Decision Point 1 Outcome and Recommendations/Protective Measures 1-7
         1.3.3.1 Are Further Steps Required to Maintain Compliance? 1-7
         1.3.3.2 Is Further Analysis Required to Assess Risk of Potential Off-Range Release? 1-8
   1.4 Report Format 1-8
2. INTRODUCTION 2-1
   2.1 History 2-1
   2.2 Command Structure 2-2
      2.2.1 Host Command 2-3
      2.2.2 Tenant Commands 2-3
      2.2.3 Explosive Ordnance Test Organizations 2-3
   2.3 Testing Process 2-3
3. PHASE I – RANGE SELECTION 3-1
4. PHASE II – PRE-SITE VISIT INFORMATION COLLECTION 4-1
   4.1 Management In-Brief 4-1
   4.2 Environmental Regulatory Applicability 4-1
5. PHASE III – ON-SITE VISIT INFORMATION COLLECTION AND REVIEW 5-1
   5.1 Range Boundary Definition 5-1
   5.2 Environmental Regulatory Compliance Assessment 5-2
      5.2.1 Air Quality 5-2
      5.2.2 Water/Wastewater 5-2
      5.2.3 Military Munitions/Solid Waste/Hazardous Materials/Hazardous Waste 5-3
      5.2.4 Cultural Resources 5-4
      5.2.5 Natural Resources 5-5
      5.2.6 Emergency Planning and Community Right-to-Know Act 5-6
      5.2.7 Environmental Planning 5-6
      5.2.8 Range Environmental and Explosives Safety Management 5-7
      5.2.9 Installation Restoration/Munitions Response 5-9
      5.2.10 Storage Tank Management and POL Management 5-11
      5.2.11 Safe Drinking Water 5-14
      5.2.12 Range Encroachment 5-15
   5.3 Operational Range Site Models 5-17
      5.3.1 Definition of Ranges 5-17
      5.3.2 Operational Component 5-18
         5.3.2.1 Historical Military Operations 5-21
         5.3.2.2 Current Military Operations 5-26
         5.3.2.3 Future Military Operations 5-28
         5.3.2.4 Overview of MCs 5-28
      5.3.3 Environmental Component 5-35

TABLE OF CONTENTS (Continued)

Page

5.3.3.1 Predominant Soil Types 5-35
5.3.3.2 Predominant Topography 5-35
5.3.3.3 Predominant Vegetation 5-35
5.3.3.4 Surface Water and Groundwater 5-39
5.3.3.5 Sensitive Receptors and Ecosystems 5-40
5.3.3.6 Cultural Resources 5-42
5.3.3.7 Groundwater and Surface Water Quality 5-44
5.3.3.8 Mainside Ranges 5-46
5.3.3.9 EEA Range 5-47
5.3.4 Summary 5-47
5.3.4.1 ORSM for Mainside Ranges 5-47
5.3.4.2 ORSM for EEA Range 5-49
5.3.5 Predictive Modeling 5-51
6. DECISION POINT 1 6-1
6.1 Are Further Steps Required to Maintain Compliance? 6-1
6.1.1 RSEPA Compliance Status Summary 6-1
6.1.2 Recommendations/Protective Measures Plan 6-3
6.2 Is Further Analysis Required to Assess Risk of Potential Off-Range Release? 6-4
6.2.1 Findings from Existing Data and ORSM 6-4
6.2.2 Recommendations/Protective Measures for Off-Range Release 6-5
7. REFERENCES 7-1

APPENDICES

APPENDIX A. MANAGEMENT IN-BRIEF
APPENDIX B. PHASE II – PRE-SITE VISIT INFORMATION COLLECTION
APPENDIX C. RCA PHASE III FORMS
APPENDIX D. ENVIRONMENTAL RESTORATION SITE MANAGEMENT PLAN AND DECISION DOCUMENT

LIST OF FIGURES

Figure		Page
1-1	NAVAL SUPPORT FACILITY DAHLGREN LOCATION MAP	1-2
1-2	NAVAL SUPPORT FACILITY DAHLGREN OPERATIONAL RANGES MAP	1-3
5-1	NAVAL SUPPORT FACILITY DAHLGREN IR SITES, AOCs, AND SWMUs	5-10
5-2	NAVAL SUPPORT FACILITY DAHLGREN LOCATIONS OF MUNITIONS-RELATED ACTIVITIES	5-20
5-3	NAVAL SUPPORT FACILITY DAHLGREN UXO DENSITY AND LOCATIONS OF DMM	5-25
5-4	CROSS-SECTION OF AN ARMOR PLATE BUTT	5-30
5-5	NAVAL SUPPORT FACILITY DAHLGREN SOILS	5-36
5-6	NAVAL SUPPORT FACILITY DAHLGREN MAINSIDE DRAINAGE FEATURES	5-37
5-7	NAVAL SUPPORT FACILITY DAHLGREN EEA DRAINAGE FEATURES	5-38
5-8	NAVAL SUPPORT FACILITY DAHLGREN CULTURAL RESOURCE LOCATIONS	5-41
5-9	NAVAL SUPPORT FACILITY DAHLGREN SPECIAL INTEREST AREAS	5-43
5-10	NAVAL SUPPORT FACILITY DAHLGREN LOCATIONS OF GROUNDWATER MONITORING WELLS AND PIEZOMETERS	5-45
5-11	NAVAL SUPPORT FACILITY DAHLGREN MAINSIDE ORSMN – MAINSIDE ORSM	5-48
5-12	NAVAL SUPPORT FACILITY DAHLGREN EEA ORSM	5-50

LIST OF TABLES

Table		Page
4-1	EXAMPLES OF ENVIRONMENTAL REGULATIONS	4-1
5-1	SUMMARY OF NSFD IR SITES (AS OF OCTOBER 2006)	5-12
5-2	SUMMARY OF MUNITIONS-RELATED ACTIVITIES OCCURRING AT NSWCDL-OPERATED RANGES	5-18
5-3	SUMMARY OF IDENTIFIED PAST MUNITIONS BURIAL SITES	5-23
5-4	HISTORICAL RANGES, ORDNANCE TESTING FACILITIES, AND TARGETS	5-24
5-5	CURRENT OPERATIONAL RANGES	5-27
5-6	SUMMARY OF MUNITIONS USAGE AND TEST EVENTS FOR 2006	5-28
5-7	CONSTITUENTS IN PRIMARY AND SECONDARY EXPLOSIVES	5-29
5-8	MASSES OF EXPLOSIVES IN VARIOUS CALIBER PROJECTILES	5-31
5-9	ADDITIVES USED IN GUN PROPELLANTS	5-32
5-10	GUN PROPELLANTS CHARGES	5-32
5-11	FIRING POINT RESIDUES FROM 155-mm HOWITZERS	5-33
5-12	WEIGHT OF MATERIAL DEPOSITED ON ALUMINUM TRAYS	5-33
5-13	PRIMARY INGREDIENTS IN PRIMERS, DELAYS, SMOKE, AND LIGHT EMITTERS	5-34
5-14	RANGE AND FREQUENCY OF PERCHLORATE DETECTIONS IN ENVIRONMENTAL MEDIA	5-44
6-1	SUMMARY OF RSEPA COMPLIANCE STATUS FOR RANGE	6-2
6-2	SUMMARY OF POTENTIAL OFF-RANGE RELEASES	6-6

LIST OF ACRONYMS AND ABBREVIATIONS

1,3,5-TNB	1,3,5-Trinitrobenzene
1,3-DNB	1,3-Dinitrobenzene
2,4-DNT	2,4-Dinitrotoluene
2,6-DNT	2,6-Dinitrotoluene
2-A-4,6-DNT	2-Amino-4,6-dinitrotoluene
4-A-2,6-DNT	4-Amino-2,6-dinitrotoluene
AA	Anti-Aircraft
ACM	Asbestos-containing Materials
Aegis BMD	Aegis Ballistic Missile Defense
ANFO	Ammonium Nitrate Fuel Oil
AOC	Area of Concern
ASN (I&E)	Assistant Secretary of the Navy (Installations and Environment)
ATRC	Aegis Training and Readiness Center
AST	Aboveground Storage Tank
ATSDR	Agency for Toxic Substances and Disease Registry
BLS	Below Land Surface
BMP	Best Management Practice
BRAC	Base Realignment and Closure
CAA	Clean Air Act
CAAA90	Clean Air Act Amendments 1990
CATEX	Categorical Exclusion
CDSA	Combat Direction Systems Activity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/sec	centimeters per second
CNIC	Commander, Navy Installation Command
CNO	Chief of Naval Operations
COMAR	Code of Maryland Regulations
CSCS	Center for Surface Combat Systems
CW	Chemical Warfare
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DBX	Depth Bomb Explosives
DCA	Dichloroethane
DCE	Dichloroethene
DDS	Data Delivery System
DMM	Discarded Military Munitions
DOD	U.S. Department of Defense
DODD	U.S. Department of Defense Directive
DODI	U.S. Department of Defense Instruction
DU	Depleted Uranium
EA	Environmental Assessment
EAP	Encroachment Action Plan
EC	Effects Concentration
EE/CA	Engineering Evaluation/Cost Analysis
EEA	Explosive Experimental Area
EIS	Environmental Impact Statement
EM	Electromagnetic
EO	Executive Order

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

EOD	Explosive Ordnance Disposal
EP	Encroachment Partnering
EPCRA	Emergency Planning and Community Right-to-Know Act
EQA	Environmental Quality Assessment
ERGM	Extended Range Guided Munition
ESA	Endangered Species Act
ESQD	Explosive Safety Quantity Distance
FFA	Federal Facility Agreement
FOTW	Federally Owned Treatment Works
FR	Federal Register
FRP	Facility Response Plan
FS	Feasibility Study
GPS	Groundwater Protection Standards
HBX	High Blast Explosives
HE	High Explosive
HMCM	Hazardous Material Control and Management
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HRS	Hazard Ranking System
HSMS	Hazardous Substance Management System
IAS	Initial Assessment Study
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
IR	Installation Restoration
IRP	Installation Restoration Program
JWAC	Joint Warfare Analysis Center
LTM	Long-term Monitoring
m	meters
MACT	Maximum Achievable Control Technology
MC	Munitions Constituent
MCL	Maximum Contaminant Level
MEC	Munitions and Explosives of Concern
mg	milligrams
MILCON	military construction
MOU	Memorandum of Understanding
MR	Military Munitions Rule
MPa	megaPascal
MR	Munitions Response
MRP	Munitions Response Program
msl	Mean Sea Level
MTR	Military Training Route
NACIP	Navy Assessment and Control of Installation Pollutants
NAMDC	Naval Air and Missile Defense Command
NAVFAC	Naval Facilities Engineering Command
NAVSEA	Naval Sea Systems Command
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDW	Naval District Washington
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFA	No Further Action

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

NHPA	National Historic Preservation Act
NORC	Naval Ordnance Research Calculator
NOV	Notice of Violation
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NSASP	Naval Support Activity South Potomac
NSFD	Naval Support Facility Dahlgren
NSWC	Naval Surface Warfare Center
NSWCDD	Naval Surface Warfare Center, Dahlgren Division
NSWCDL	Naval Surface Warfare Center, Dahlgren Laboratory
NT	Nitrotoluene
OB/OD	Open Burn/Open Detonation
ODCP	Oil Discharge Contingency Plan
OMB	Office of Management and Budget
OPA90	Oil Pollution Act of 1990
OPAREA	Operations Area
OPNAVINST	Operational Navy Instruction
OPP	Oil Pollution Prevention Regulation of 1973
ORC	Operational Range Clearance
ORSM	Operational Range Site Model
OSHA	Occupational Safety and Health Administration
PAH	Polynuclear Aromatic Hydrocarbon
PAO	Public Affairs Office
PBX	Plastic Bonded Explosives
PCB	Polychlorinated Biphenyl
PETN	Pentaerythritol Tetranitrate
PHA	Public Health Assessment
PIWG	Public Information Working Group
POL	Petroleum, Oils, and Lubricants
ppt	parts per thousand
PRTR	Potomac River Test Range
PTE	Potential to Emit
RAB	Restoration Advisory Board
RACM	Regulated Asbestos-containing Material
RCA	Range Condition Assessment
RCRA	Resource Conservation and Recovery Act
RDT&E	Research, Development, Test, and Evaluation
RDX	Hexahydro-1,3,5-triniro-1,3,5-triazine
RF	Radio Frequency
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RSEPA	Range Sustainability Environmental Program Assessment
SAIA	Sikes Act Improvement Act
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act
SCP	Spill Contingency Plan
SDWA	Safe Drinking Water Act
SERDP	Strategic Environmental Research and Development Program

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

SHPO	State Historic Preservation Office
SIA	Special Interest Area
SIPS	Sound Intensity Prediction System
SOP	Standard Operating Procedure
SPCC	Spill Prevention Control and Countermeasures
SPCS	Space Control Squadron
SSP	Site Screening Process
SSPR	Site Screening Process Report
SUA	Special Use Airspace
SVOC	Semivolatile Organic Compound
SW	Solid Waste
SWMU	Solid Waste Management Unit
SWP3	Stormwater Pollution Prevention Plan
T&E	Threatened and Endangered
TCA	Tetrachloroethane
TEAM	The Environmental Assessment and Management
Tetryl	Methyl-2,4,6-trinitrophenylnitramine
TMP	Tank Management Plan
TNT	2,4,6-Trinitrotoluene
TPR	Test Planning Record
TRI	Toxics Release Inventory
UCMR	Unregulated Contaminant Monitoring Regulation
UL	Underwriter’s Laboratory
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	Underground Storage Tank
UXO	Unexploded Ordnance
VAC	Virginia Administrative Code
VDCR-DNH	Virginia Department of Conservation and Recreation, Division of Natural Heritage
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
VOC	Volatile Organic Compound
VPDES	Virginia Pollutant Discharge Elimination System
VR	Virginia Regulation
VSI	Visual Site Inspection

THIS PAGE WAS INTENTIONALLY LEFT BLANK

1. EXECUTIVE SUMMARY

Purpose

The Naval Surface Warfare Center, Dahlgren Laboratory (NSWCDL) was required to conduct a Range Condition Assessment (RCA), which was the first phase of the Range Sustainability Environmental Program Assessment (RSEPA) process developed by the Chief of Naval Operations (CNO) N45. The purpose of RSEPA was to support sustainment of Navy test and training ranges by assessing and managing the present environmental condition of each land-based range under the Navy's control. Knowledge of range-specific environmental conditions helps managers make informed decisions and reduces the overall planning required for Navy operational activities. In addition, awareness of range environmental conditions helps managers better understand appropriate measures to implement to ensure compliance with environmental laws and regulations.

Background

NSWCDL provides state-of-the-art research, development, test, and evaluation (RDT&E), engineering, and fleet support for surface warfare systems, ordnance, mines, amphibious warfare systems, mine countermeasures, special warfare systems, and strategic systems. NSWCDL, which is part of the Naval Sea Systems Command (NAVSEA), operates ranges and provides management support services such as environmental program management and public affairs support that are specifically related to the NSWCDL mission. As host to NSWCDL, the Naval Support Activity South Potomac (NSASP) is responsible for shore support services at Naval Support Facility Dahlgren (NSFD), including all land and buildings.

This RCA focused on the land components of the ranges, located at NSFD, that NSWCDL manages and operate where munitions are used and have been used since the early 1900s. This document was prepared for NSWCDL and NAVSEA.

NSFD is approximately 23 miles east of Fredericksburg, Virginia; 68 miles south of Washington, DC; and 55 miles north of Richmond, Virginia on the Potomac River (Figure 1-1). Since 1918, this area has been used for military testing purposes. NSFD consists of 4,300 land acres that include several miles of Potomac River shoreline. NSWCDL-operated ranges include a 51-mile downriver range for RDT&E, including firing projectiles.

This report documents the RSEPA RCA that was conducted at six NSWCDL land-based ranges. The purpose of the RCA was to obtain and evaluate information needed to address the following questions from Decision Point 1 of the RSEPA Policy Implementation Manual for the land-based ranges at NSFD: "Are further steps required to maintain compliance?" and "Is further analysis required to assess the risk of an off-range release?"

To address these questions, the RCA assessed the following six land-based ranges as shown in Figure 1-1 where munitions operations are conducted: Anti-Aircraft (AA) Fuze Range, Explosive Experimental Area (EEA) Range, Machine Gun Range, Main Range, Missile Test Range, and Terminal Range. This synopsis does not address the Potomac River Test Range (PRTR), which is a water-based range as shown in Figure 1-2.

As shown in Figure 1-1, NSFD is divided into two areas separated geographically by Upper Machodoc Creek. Mainside is the northern area that encompasses 2,678 acres and is used for operational and support activities, and military housing. NSWCDL mainside ranges include a gunnery complex that faces downriver, with 42 gun emplacements capable of firing all types of naval guns up to and including 16-inch guns, which are no longer fired. The majority of munitions fired into PRTR do not contain high

FIGURE 1-1. NAVAL SUPPORT FACILITY DAHLGREN LOCATION MAP

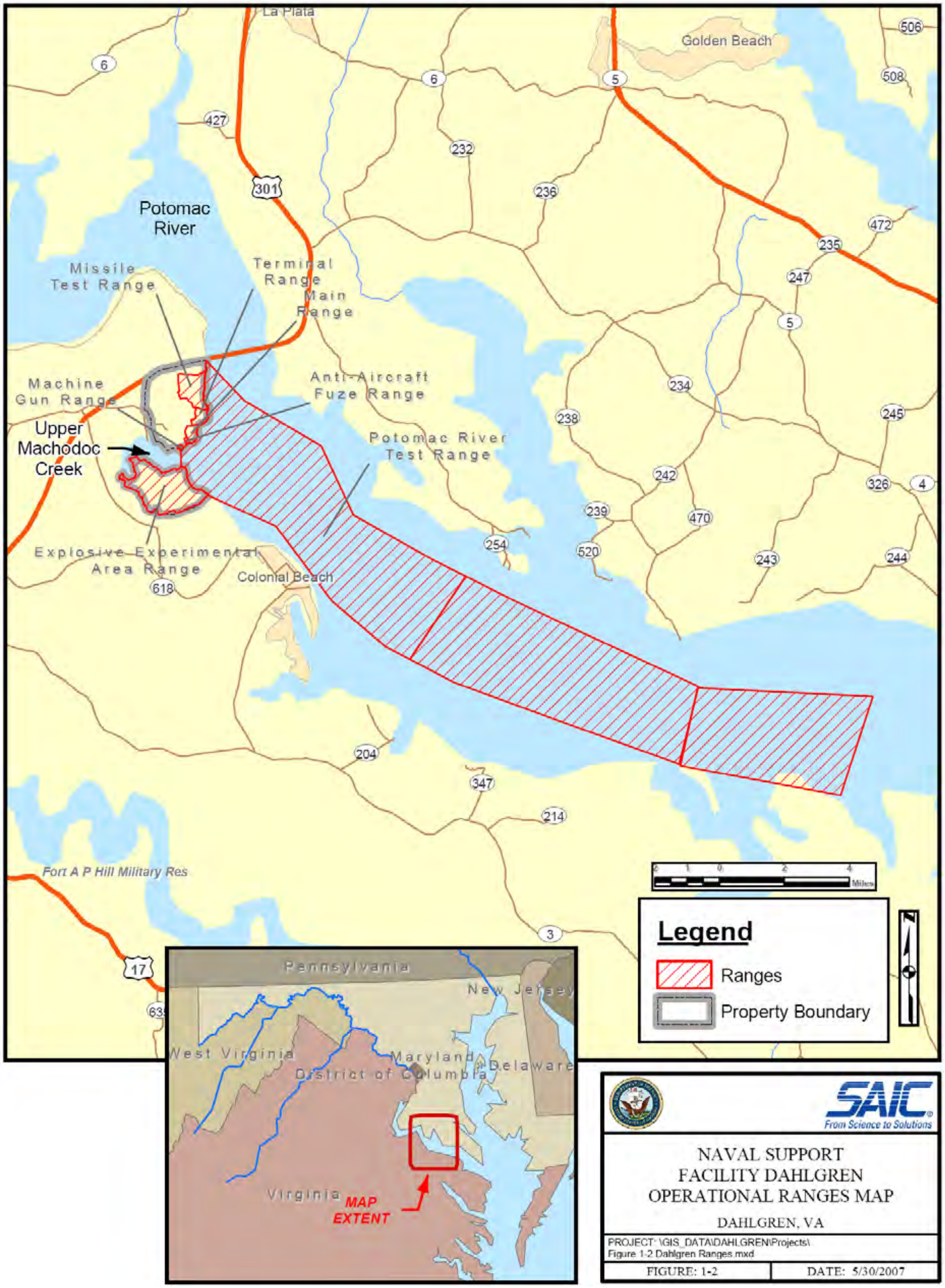


FIGURE 1-2. NAVAL SUPPORT FACILITY DAHLGREN OPERATIONAL RANGES MAP

explosives. In fact, live munitions were not fired into PRTR before World War II and only approximately 18 percent of the 6,297 rounds fired into the PRTR in calendar year 2006 were high explosive (HE) rounds. The following bullets summarize the major activities conducted at the five land-based ranges on Mainside:

- ***AA Fuze Range***—Provides a naval environment for guns and ammunition components testing.
- ***Machine Gun Range***—Used for testing of 40mm and/or smaller guns and ammunition as well as penetration testing of light armor materials.
- ***Main Range***—Used for systems integration and testing with networked connectivity to most shipboard combat system elements.
- ***Missile Test Range***—Used to conduct overland test and evaluation of vehicles and special weapon components against targets.
- ***Terminal Range***—Supports RDT&E and production testing of weapon systems, components, and other ordnance material, specifically experimental items.

The second area with NSWCDL-operated ranges on NSFD is the EEA Range. Otherwise known as Pumpkin Neck, the EEA Range is south of Upper Machodoc Creek and is 1,641 acres. It is located on Tetotum Flats and contains the Churchill and Harris Ranges. Although not specifically designated as ranges, the open burn/open detonation (OB/OD) units located on Churchill Range on EEA also are included in this RCA.

1.1 REVIEW OF PHASE I – RANGE SELECTION

NSFD is the leading naval facility for scientific and technological RDT&E in such diverse areas as surface ship combat systems, ordnance, strategic and strike systems, and theater warfare. NSWCDL has five technical departments, each responsible for a particular RDT&E effort in support of the Navy and U.S. Department of Defense (DOD). NSFD also hosts the following tenants: Aegis Ballistic Missile Defense (Aegis BMD), the Center for Surface Combat Systems (CSCS)/Aegis Training and Readiness Center (ATRC), Naval Facilities Engineering Command (NAVFAC), and the Joint Warfare Analysis Center (JWAC).

Given the high strategic value of the ranges that NSWCDL manages and operates, CNO N45 and NAVSEA selected these operational land-based assets to undergo an RCA.

1.2 REVIEW OF PHASE II – PRE-SITE VISIT INFORMATION

The Technical Team consisting of Navy civilians and personnel from Science Applications International Corporation (SAIC) conducted the RCA (Phase II Pre-Site Visit Information Collection) from 15 September through 27 October 2006. During Phase II, the Team coordinated with Navy personnel thoroughly familiar with the coordination between range and environmental personnel and collected initial information to prepare for Phase III.

The Management In-Brief was conducted by Ms. Wanda Holmes (CNO) and Ms. Vickie Writt (NAVSEA 04) on 8 November 2006. Captain Joseph McGettigan represented Naval Surface Warfare Center, Dahlgren Division (NSWCDD) and Captain Judy Smith represented the Commander, Navy Installation Command (CNIC) at the in-brief. Additional Navy civilians and one member of SAIC's Technical Team participated in the Management In-Brief.

1.3 REVIEW OF PHASE III – ON-SITE VISIT INFORMATION

The Technical Team consisting of Navy civilians and personnel from SAIC conducted the RCA Phase III (On-site Visit Information Collection and Review) from 30 October to 1 November 2006. The Team interviewed key Navy personnel responsible for range and environmental operations and collected range, operational, and environmental information about ranges where operations with munitions are conducted.

The key Navy personnel that the Technical Team interviewed were located at NSFD in Dahlgren, Virginia, and were affiliated with the following organizations:

- NSFD Environmental
- NSWCDL Range Safety Director (G604)
- NSWCDL Range Control (G61)
- NSWCDL Ammunition Support (G61)
- NSWCDL EEA (G64)
- NSWCDL Safety and Environmental (CX8).

In addition, the Technical Team conducted a tour of the NSWCDL-operated ranges. The information obtained during the RCA Phase III was used to complete an environmental compliance assessment (Section 1.3.1), develop the operational range site models (ORSMs) (Section 1.3.2), and address the two key RSEPA Decision Point 1 questions identified earlier.

1.3.1 RCA Environmental Compliance

This report assesses the environmental compliance status of land-based ranges at NSFD. Section 4.2 summarizes the applicable environmental laws, regulations, and requirements to NSWCDL range operations. The environmental compliance evaluation (Section 5.2) includes a summary of the compliance status and major issues found for all possible environmental areas at the six ranges assessed during Phase III.

During the RCA, information was collected about the possible impacts of range operations on the environment. Efforts focused on munitions usage on land-based components of NSWCDL operational ranges. The collected information was reviewed and analyzed for environmental regulatory applicability and compliance deficiencies.

Phase II and III information collection efforts included interviews of range personnel and environmental managers to determine what environmental and range management programs are in place and to what extent these programs address environmental regulatory requirements and current and potential environmental and human health risks due to range operations.

The assessment areas were chosen based upon those environmental compliance and explosives safety management areas found in the Navy's RSEPA Policy Implementation Manual, the U.S. Army Corps of Engineers' (USACE) The Environmental Assessment and Management (TEAM) Guide – Virginia Supplement, and Operational Navy Instruction (OPNAVINST) 5090.1C. The environmental compliance, explosives safety management, and range encroachment areas addressed during interviews included the following:

- Air Quality
- Water/Wastewater
- Military Munitions/Solid Waste/Hazardous Materials/Hazardous Waste
- Cultural Resources
- Natural Resources

- Emergency Planning and Community Right-to-Know Act (EPCRA)
- Environmental Planning
- Range Environmental and Explosives Safety Management
- Installation Restoration (IR)/Munitions Response
- Storage Tank and Petroleum, Oils, and Lubricants (POLs) Management
- Safe Drinking Water, and
- Range Encroachment.

The findings and recommendations resulting from the analysis of the areas listed above are summarized in Sections 1.3.3.1 and 1.3.3.2. More detailed discussions concerning RCA environmental compliance are presented in Section 5.2.

1.3.2 Overview of Operational Range Site Models

This report includes the Operational Range Site Models (ORSMs) developed for munitions-related RDT&E operations conducted by the Navy at NSWCDL-operated ranges. Since the five land-based Mainside ranges are adjacent to each other, located in similar environments, and comparable in usage and age, they are included in one ORSM. The ORSM for EEA will include the Churchill and Harris Ranges and the OB/OD units. Each of these ranges is adjacent to the PRTR, which is not a component of this RCA as water-based ranges are not addressed.

The ORSMs summarize operational, environmental, and land use conditions that will be used to support conclusions and recommendations concerning the potential for off-range migration of munitions constituents (MCs). MCs are defined in the RSEPA Policy Implementation Manual as materials originating from military munitions, including explosive and nonexplosive materials, and the emissions, degradation, or breakdown products of such munitions, potentially including, but not limited to, the following:

- 2-Amino-4,6-dinitrotoluene (2-A-4,6-DNT)
- 4-Amino-2,6-dinitrotoluene (4-A-2,6-DNT)
- 1,3-Dinitrobenzene (1,3-DNB)
- 2,4-Dinitrotoluene (2,4-DNT)
- 2,6-Dinitrotoluene (2,6-DNT)
- Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
- Methyl-2,4,6-trinitrophenylnitramine (Tetryl)
- Nitrobenzene
- Nitroglycerin
- 2-Nitrotoluene
- 3-Nitrotoluene
- 4-Nitrotoluene
- Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)
- Perchlorate
- 1,3,5-Trinitrobenzene (1,3,5-TNB)
- 2,4,6-Trinitrotoluene (TNT), and
- Metals (e.g., aluminum, arsenic, lead, and mercury).

Because of the extensive multi-media sampling and monitoring associated with the NSFD/NAVFAC Installation Restoration Program (IRP) and the NSWCDL Resource Conservation and Recovery Act (RCRA) permit required to operate the OB/OD units, predictive modeling was not conducted. This RCA report, however, still provides the information needed to address the second Decision Point 1 question concerning the potential risk of an off-range release of MCs.

ORSMs use existing knowledge to describe land-based operational ranges and their environments in both graphical and tabular formats. ORSMs summarize operational and potential release information, migration and exposure pathways, and expected locations of potential releases. They summarize the links between potential sources of MCs, release mechanisms, exposure pathways, exposure routes, and receptors. ORSMs include range boundaries, topography, vegetation, and hydrology to the extent that is known through available historical information and a range visit.

1.3.3 Decision Point 1 Outcome and Recommendations/Protective Measures

The following sections summarize the results of RCA Phases II and III. The sections summarize answers to the two Decision Point 1 questions. More detailed information concerning the compliance status (question 1) is provided in Section 5.2 and the potential for an off-range release (question 2) is provided in Section 5.3.

1.3.3.1 Are Further Steps Required to Maintain Compliance?

Overall, RDT&E operations at NSWCDL-operated ranges are in compliance with applicable environmental program requirements. The following recommendations resulted from the Phase III analysis:

- ***Air Quality***—No deficiencies observed through reviews of records or during interviews conducted with NSFD/NAVFAC personnel.
- ***Water/Wastewater***—NSFD/NAVFAC needs to update the Industrial Wastewater Stormwater Pollution Prevention Plan Operations and Maintenance Manual to meet Virginia Pollutant Discharge Elimination System (VPDES) permit conditions. Operational Range Clearance (ORC) Best Management Practices (BMPs) will be followed to reduce potential risks to human health and/or the environment if munitions are exposed via erosion from past range operations as identified in Figure 5-3, which includes the Old Plate Battery Test Area. Actions will be taken to stabilize the Old Battery Test Area. It should be noted that exposed munitions would not constitute an off-range release; however, MCs potentially released to the Potomac River could be regulated under the Code of Maryland Regulations (COMAR) 26.08.01 and 26.08.01.02.
- ***Military Munitions/Solid Waste/Hazardous Materials/Hazardous Waste***—Munitions from past range operations as identified in Figure 5-3, which includes the Old Plate Battery Test Area, will be removed if they become exposed due to erosion or other processes. Once removed, they will be managed in accordance with applicable federal and state regulations.
- ***Cultural Resources***—An Integrated Cultural Resources Management Plan (ICRMP) is being developed by NSFD/NAVFAC.
- ***Natural Resources***—The Integrated Natural Resources Management Plan (INRMP) was updated in November 2007.
- ***EPCRA***—No deficiencies observed.
- ***Environmental Planning***—No deficiencies observed. NSWCDL is preparing an Environmental Impact Statement (EIS) for increased outdoor RDT&E operations. This will ensure that NSWCDL can continue to conduct required RDT&E mission operations into the future.
- ***Range Environmental and Explosives Safety Management***—Munitions exposed from past range operations identified in Figure 5-3, including the Old Plate Battery Test Area, will be handled per the ORC Plan to reduce potential risks to human health and/or the environment. Actions will be taken to stabilize the Old Plate Battery Test Area. In the interim, new signs will

be posted along the Old Plate Battery Test Area to prevent unauthorized access by trespassers from boats.

- ***Installation Restoration (IR)/Munitions Response (MR) Projects***—NSFD/NAVFAC is the point of contact for all MR and IR sites on NSFD. NSFD also receives requests for munitions response assistance from the local community for which NSWCDL Explosive Ordnance Disposal (EOD) provides off-station support in accordance with a Memorandum of Understanding (MOU) between NSWCDD, NSASP, and King George County. NSWCDL is responsible for the execution of recovery, handling, transportation, storage, and final disposition of munitions and explosives of concern (MEC), unexploded ordnance (UXO), and discarded military munitions (DMM) within and outside operational ranges.
- ***Storage Tank and POL Management***—No deficiencies observed.
- ***Safe Drinking Water***—The Operations and Maintenance Plan for the public drinking water supply system needs to be updated by NSFD/NAVFAC to reflect current water distribution maps and well locations. This update should include new and removed wells and reflect changes in staffing and responsibilities. The Unregulated Contaminant Monitoring Regulation (UCMR) as specified in the Safe Drinking Water Act (SDWA) Amendments of 1996 may apply to perchlorate.
- ***Range Encroachment***—NSWCDL has identified challenges that threaten the ability to conduct RDT&E operations, sustain core capabilities, and execute the mission. Encroachment due to population growth is the most significant of these challenges, and threatens to limit RDT&E operations. Issues are discussed further in Section 5. Successful encroachment management programs will minimize impediments to operations and maintain the capability to perform the mission.
- ***Constituents***—Perchlorate, RDX, and HMX detected in the groundwater of the Columbia aquifer at the OB/OD on EEA are being investigated in coordination with NSWCDL and the Virginia Department of Environmental Quality (VDEQ). Groundwater protection standards (GPS) have been established at the OB/OD by VDEQ. Self-imposed perchlorate evaluations for non-OB/OD sites are ongoing and are summarized in Section 5.

1.3.3.2 Is Further Analysis Required to Assess Risk of Potential Off-Range Release?

The Navy is already investigating areas and in most cases has already addressed areas where there is a potential for an off-range release of MCs through:

- The IRP
- Subpart X permitting requirements.

There is no need to investigate any areas for potential off-range releases of MCs beyond investigations already planned. In addition, the ongoing EIS will evaluate the impact of past, present, and future ordnance operations on the environment.

1.4 REPORT FORMAT

The following sections summarize the information included in this synopsis to complete this evaluation:

- ***Section 1***—Provides an Executive Summary of the RSEPA RCA conducted for NSWCDL-operated ranges.
- ***Section 2***—Introduces the history of NSWCDL-operated ranges, structure of host and tenant commands, and process for planning and conducting tests.

- ***Section 3***—Summarizes the key elements of RCA Phase I – Range Selection.
- ***Section 4***—Discusses the Management In-Brief and summarizes the environmental regulations reviewed for applicability to range operations.
- ***Section 5***—Presents the results of RCA Phase III – On-site Visit Information Collection and Review. It includes the definition of the range boundary and presents each of the environmental compliance areas assessed and any deficiencies noted as a result of the Phase III information collection process. In addition, Section 5 presents the ORSMs for Mainside and EEA Ranges. It includes information about historical, current, and planned future military operations at Dahlgren and describes where military testing occurs on the ranges. Section 5 also details the physical environment of NSFD and describes factors that may affect MC release, fate and transport, and potential receptors. Land use and information that could be used to identify and evaluate the applicable scenarios and locations of human and ecological exposure to potential releases of MCs also are included in Section 5.3.4.
- ***Section 6***—Presents the conclusions relative to the two Decision Point 1 questions.
- ***Section 7*—**Lists the references that were used in preparing this report.

The following appendices are presented at the end of this document:

- ***Appendix A***—Management In-Brief presented on 8 November 2006.
- ***Appendix B***—Details of RCA Phase II – Pre-Site Visit Information Collection. It discusses the assessment of environmental regulatory applicability.
- ***Appendix C***—Completed RSEPA forms.
- ***Appendix D*—**2008 Environmental Restoration Site Management Plan and Decision Document for No Action or Deferral Action at Sites 1 and 5.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

2. INTRODUCTION

2.1 HISTORY

Military operations began at Dahlgren in June 1918. At that time, the Naval Proving Ground obtained 994.3 acres between Upper Machodoc Creek and Lower Cedar Point Light in the Potomac River by means of a Presidential proclamation. The adjoining Arnold Farm was added in November 1918 and Blackistone Island (approximately 30,000 yards downriver from the Naval Proving Ground) was added in March 1919, both as a result of Presidential proclamations. Blackistone Island was used primarily as a target for major caliber projectiles, which then could be recovered for analysis (Navy 1983b). Prior to 1918, the Navy had operated a proving ground at Indian Head, Maryland, but Indian Head could no longer support the river range testing, which required a larger range. Considering its location on the Upper Machodoc Creek near the Potomac River, Dahlgren's 4,500-acre site was ideal for testing long-range naval guns.

Actual operations at the Naval Proving Ground began on 16 October 1918, with the successful firing of a 7-inch, 45-caliber tractor-mounted gun from an area known as the Lower Station. In 1919, the Lower Station was named "Dahlgren" to honor Rear Admiral John Adolphus Dahlgren, a Civil War Navy commander who is known as the "father of modern naval ordnance" (Navy 1983b).

Ordnance material testing was centered at the Main Battery (later known as the Armament Department) from 1919 to 1921. Initially, it included a Broad-side Battery, Fuze Testing Battery, Ammunition, Velocity Range, and Interior Ballistics Section. Buildings 123 and 124 were constructed as ammunition storage magazines in 1921 and are still used today. The first powder test report was submitted in March 1921. The first firing against ship armor plating was performed on 25 July 1921 against a 9-inch-thick steel plate of the type destined for the USS Indiana. At one time, one out of every six or seven slabs of 17-inch-thick armor plating was proof-tested at Dahlgren.

Since inception, ordnance tests were conducted at Dahlgren through the complete range of naval surface weaponry ranging from the smallest machine guns to the largest 16-inch guns (Navy 1983b). The last functional 16-inch gun mount, although no longer used, is located at NSFD.

The Main Battery was expanded between 1926 and 1935 to include multiple gun emplacements and mounts. Special ballistics studies and investigations related to target penetration conducted from 1924 to 1930 led to the construction of the Armor and Projectile Laboratory in 1940. All projectiles fired at Dahlgren Naval Proving Ground until World War II were reportedly inert (McCollum 1977 as referenced in Navy 1983b), although the projectiles were still dangerous because they often were fitted with fuzes and detonators (Navy 1983b). From 1936 through World War II, glide and dive bombsights and low-altitude bombing devices (Navy 1983b) were tested at Dahlgren.

During World War II, the Armament Department tested guns of all calibers, mounts, projectiles, powders, aerial and impact fuzes, primers, cases, tracers, depth charge guns, explosives, and rockets and rocket launchers. The tests were conducted to ensure material strength, functional reliability, and accuracy. Wartime changed the nature of ammunition testing from inert loading and target practice ammunition to occasional processing of live wartime ammunition. Throughout the war, proof and testing increased, as did RDT&E activities. At Dahlgren, a flashless gun decoppering powder was invented, new and improved armor materials and installation methods were developed, and preliminary tests of the operations of proximity fuze principles were conducted (Navy 1983b).

The workload fluctuated at Dahlgren between World War II and the Korean War. From 1946 through the Korean War, the Navy began working in the field of computations and developed the Naval Ordnance Research Calculator (NORC) at Dahlgren. The workload increased during the Korean War. In 1953, operations shifted from guns to missiles as reflected by the construction of Building 999 (Rocket

Armament Building), Building 1104 (3,000-foot Rocket Launcher), Building 1115 (Hydrazine Magazine), and Building 1116 (Hydrogen Peroxide Building). In 1959, the Dahlgren Naval Proving Ground was changed to the Dahlgren Naval Weapons Laboratory (Navy 1983b).

Beginning in 1946, atomic weaponry testing related to the Bikini Atomic blasts, which led to Project Elsie, involved Dahlgren. Dahlgren served as the test center for bombs that would detonate after penetration. The testing of flight characteristics of various proposed body designs and development of proximity fuzes used with the bomb were primarily conducted at Dahlgren. However, no radioactive material was used during testing at Dahlgren (NSWC 2007). The project was transferred to the Atomic Energy Commission in 1956 (Navy 1983b).

During the 1960s, satellite geodesy, projectile and warhead development, armor material development and testing, air and ground target vulnerability studies, weapons systems aiming data collection, surface warfare exercise computation model developments, Polaris submarine ship loading computer simulation model development, gun systems testing and evaluation, and laser operations and studies were conducted at Dahlgren. Ordnance proof and testing increased in intensity during the Vietnam War. From 1969 to 1970, seven liquid propellant magazines (Buildings 1305 to 1311) and the fenced Chemical Burn Area were constructed (Navy 1983b).

In 1974, Dahlgren Naval Weapons Laboratory merged with the Naval Ordnance Laboratory, White Oak, Maryland to form the Naval Surface Weapons Center. In 1991, under the Base Realignment and Closure (BRAC) Act, Dahlgren was assigned to a Naval Surface Warfare Center (NSWC) "megacenter" and was renamed Naval Surface Warfare Center, Dahlgren Division (NSWCDD).

NSFD continues to be the major testing area for naval gun ballistics. Past historical milestones at Dahlgren include (Navy 2006b):

- First tests of radio-controlled aircraft conducted in 1923
- First calibrations of bombs began in 1923
- Location of the first Navy ordnance computer, the Mark I Aiken Dahlgren Relay Calculator
- Development and testing of the Norton bombsight, which helped win World War II
- Provision of scientific expertise that was tapped for the Manhattan Project during World War II for the development of the atomic bomb
- Establishment of Navy ordnance schools during World War II
- Home base for the Polaris program's mathematical specifications and computer programs, and
- Development and long-term support of the Aegis computer system for operational Aegis cruisers and destroyers.

Additional historical information as it relates to the two key RSEPA Decision Point 1 questions is provided in Sections 4 and 5.

2.2 COMMAND STRUCTURE

NSWCDD is one of six NSWC divisions. NSWCDD is composed of two major sites: NSWCDL at NSF, Dahlgren, Virginia and Combat Direction Systems Activity (CDSA) at Dam Neck in Virginia Beach, Virginia. This RCA was conducted only for NSWCDL land-based ranges.

NSWCDL's host command is NSASP, who is responsible for oversight and maintenance of all real property (land and all items (buildings, structures, and utilities) assigned and constructed on or in the land). The tenant commands are responsible for executing their respective missions. NSWCDL is the primary tenant involved with energetic operations. These commands and their responsibilities are discussed below.

2.2.1 Host Command

In October 2003, CNIC was officially commissioned to provide shore support services to Navy activities. All land and buildings at Navy bases transitioned to CNIC in 16 regional commands. NSASP was commissioned in November 2005. NSASP includes NSF in Dahlgren, Virginia; Indian Head, Maryland; Andrews Air Force Base, Maryland; and Fort Belvoir, Virginia (courtesy of dcmilitary.com). NSASP reports to Naval District Washington (NDW), which in turn reports to CNIC.

NSASP/NAVFAC staff includes personnel located at NSFD who are responsible for environmental management of all base operations. These personnel work with NSWCDL environmental staff located at Dahlgren, who are responsible for environmental requirements associated with the NSWCDL mission.

2.2.2 Tenant Commands

Originally established for the testing of major naval ordnance (including battleship main battery armament of 16-inch and larger calibers), the mission of NSWCDL has evolved to include a wide variety of weapons-related RDT&E functions. Besides NSWCDL, major tenants at NSFD include:

- CSCS/ATRC Dahlgren
- Aegis BMD
- Naval Air and Missile Defense Command (NAMDC)
- NAVFAC
- JWAC, and
- Space Control Squadron (SPCS).

NSWCDL currently comprises five technical departments (Navy 2006b): Z, G, K, W, and Q.

2.2.3 Explosive Ordnance Test Organizations

The primary department responsible for conducting RDT&E activities with energetics on NSWCDL-operated ranges is the Engagement Systems Department (G). This department is responsible for the development, maintenance, administration, and operation of the NSWCDL-operated ranges and major test facilities (e.g., surveillance radars, tracking complex, and meteorological systems) (Navy 1983a). Representatives from several organizations supporting the Engagement Systems Department (G) were interviewed during RCA Phase III.

2.3 TESTING PROCESS

NSWCDL follows an established process for developing, reviewing, and approving Standard Operating Procedures (SOPs) and Test Planning Records (TPRs) for every RDT&E operation conducted with energetics and/or ordnance on NSWCDL-operated ranges.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

3. PHASE I – RANGE SELECTION

NSWCDL, composed of five technical departments, is the leading naval entity for scientific and technological RDT&E in such diverse areas as surface ship combat systems, ordnance, strategic and strike systems, and theater warfare. The coastal environment and varied climate at NSFD make the NSWCDL-operated ranges an ideal location for testing weapons under realistic environmental conditions that can be found throughout the world. This is necessary because weapon systems and sensors function differently over water than land. In fact, the PRTR is the largest fully instrumented over-the-water gun firing range in the nation. Furthermore, NSWCDL, including the scientists and engineers employed at Dahlgren, are in close proximity to Washington DC, and numerous military installations, which fosters scientific, technical, and operational collaboration across military services and government agencies (NSWC 2005b and 2005c).

Given the high strategic value of the NSWCDL-operated ranges, the operational land-based assets have been selected to undergo an RCA by CNO N45 and NAVSEA.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

4. PHASE II – PRE-SITE VISIT INFORMATION COLLECTION

4.1 MANAGEMENT IN-BRIEF

The Management In-Brief was conducted by Ms. Wanda Holmes (N45) and Ms. Vickie Writt (NAVSEA Headquarters) on 8 November 2006. Captain Joseph McGettigan represented NSWCDD and Captain Judy Smith represented CNIC at the in-brief. Additional Navy civilians and one member of SAIC's Technical Team participated in the Management In-Brief. The briefing is included as Appendix A.

4.2 ENVIRONMENTAL REGULATORY APPLICABILITY

Table 4-1 summarizes the environmental regulations that the Technical Team reviewed for applicability to range operations. Details of Federal, state, local, Navy, and DOD environmental statutes, regulations, and requirements to operations and facilities associated with land-based range operations at NSWCDL-operated ranges are provided in Appendix B.

TABLE 4-1. EXAMPLES OF ENVIRONMENTAL REGULATIONS

Primary Regulations	Other Regulations
• Clean Air Act (CAA), 42 United States Code (U.S.C.) 7401 et seq. • Clean Water Act (CWA), 33 U.S.C. Sect 1251 to 1387 • Coastal Zone Management Act (CZMA), 16 U.S.C. 1451 et seq. • Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601 to 9675 • EPCRA, 42 U.S.C. 11001 to 11050	• Endangered Species Act (ESA) • Migratory Bird Treaty Act, 16 U.S.C. 703 • National Environmental Policy Act (NEPA), 42 U.S.C. 4321 to 4370e • National Historic Preservation Act (NHPA) • RCRA, 42 U.S.C. 6901 to 6992k • SDWA, 42 U.S.C. 300f-300j-26

THIS PAGE WAS INTENTIONALLY LEFT BLANK

5. PHASE III – ON-SITE VISIT INFORMATION COLLECTION AND REVIEW

The assessment of environmental compliance serves as the basis for addressing the first of the two major questions posed during Decision Point 1 of the RSEPA process. During the RCA Phase III, information is collected about the possible impacts from range operations on the environment. Efforts during the RCA Phase III are focused on munitions usage on land-based operational ranges. The collected information is reviewed and analyzed for applicability to environmental regulations and potential compliance deficiencies and for determining the potential for an off-range release of MCs.

Initially, pertinent information was gathered and reviewed in order to plan the on-site visit. The Technical Team used this information to assess compliance at operational ranges (Mainside and EEA). Following information gathering and review, range personnel and environmental managers were interviewed to determine what environmental and range management programs are in place and to what extent these programs addressed environmental regulatory requirements and current and potential environmental and human health risks due to range operations. The environmental compliance and explosives safety management areas addressed during interviews and in this document include:

- Air Quality
- Water/Wastewater
- Military Munitions/Solid Waste/Hazardous Materials/Hazardous Waste
- Cultural Resources
- Natural Resources
- EPCRA
- Environmental Planning
- Range Environmental and Explosives Safety Management
- IR/Munitions Response
- Storage Tank and POL Management
- Safe Drinking Water, and
- Range Encroachment.

The assessment areas listed above were chosen based upon those environmental compliance, explosives safety management, and encroachment areas found in the Navy's RSEPA Policy Implementation Manual (Navy 2006a), TEAM Guide – Virginia Supplement (USACE 2006), and OPNAVINST 5090.1C (Navy 2003). Technical Team members analyzed the information gained from the range visit, interviews, and documents received. The Team documented their findings as individual reports for their assigned environmental media. These individual reports are contained in Appendix C. Section 5.2 summarizes the Team members' individual reports and entails the Team's environmental compliance assessment of the NSWCDL-operated ranges.

Section 5.1 defines the boundaries of the NSWCDL operational ranges, Section 5.2 includes the evaluation of compliance with environmental requirements, and Section 5.3 includes the ORSMs for Mainside and EEA Ranges.

5.1 RANGE BOUNDARY DEFINITION

The range boundaries for the Mainside and EEA Ranges are shown in Figure 1-2. The Mainside Ranges are adjacent to each other, but otherwise, the range boundaries are represented by shoreline, Navy property line, and nonrange land areas. The EEA Range boundary is represented by shoreline and Navy property line.

5.2 ENVIRONMENTAL REGULATORY COMPLIANCE ASSESSMENT

The following sections discuss the environmental and operational areas that were assessed at NSWCDL-operated ranges in terms of the environmental compliance and explosives safety management areas listed above.

5.2.1 Air Quality

Conclusion

Per discussions with the host Air Program Manager, the ranges are in compliance with all applicable air quality regulations. The potential to emit (PTE) is recalculated as new sources are added to ensure that these sources did not cause the PTE level to approach Title V limits.

Discussion

The CAA and its amendments apply to ranges, their operations, and support facilities. The majority of air quality regulations apply to stationary emission sources, which in Virginia, are regulated by VDEQ, Division of Air Quality. NSFD lies within an air basin that is in attainment with Federal and state ambient air quality standards. This means that NSFD is not subject to the General Conformity Rule and, in general, is not subject to as many regulations as it would be if it were located in a nonattainment air basin.

NSFD is not required to have a Federal Title V Operating Permit, according to VDEQ, and is not a major source for any criteria or hazardous air pollutants. Instead, NSFD maintains a VDEQ synthetic minor operating permit. NSFD has a number of stationary fuel tanks and generators that are permitted emission sources, and a number of permitted mobile sources, including diesel and gasoline generators and mobile fuel tanks. The air emissions inventory conducted in the early 1990s did not indicate PTEs that would require a Title V Permit or monitoring. It should be noted that the Commonwealth of Virginia reviews permitted sources on-site every 2 years and has not been concerned with the PTE.

The VDEQ, Division of Air Quality was given a copy of the OB/OD permit application for review and comment. VDEQ reviews the OB/OD process during their biennial inspection and has indicated this activity is not a process requiring a permit. This, however, has not been obtained in writing. Per discussions with the NSFD/NAVFAC Air Program Manager, there are no source categories at NSFD that are subject to the Clean Air Act Amendments 1990 (CAAA90), Title III, maximum achievable control technology (MACT) standards.

The Federal Asbestos National Emission Standards for Hazardous Air Pollutants (NESHAP) regulation would apply to any structures at NSFD that contain regulated asbestos-containing material (RACM) and the abatement and demolition of those materials. An asbestos survey was conducted for buildings at NSFD, and asbestos-containing materials (ACM) were abated or contained as needed. NAVFAC has conducted asbestos surveys and conducts sampling prior to construction, demolition, or remodeling activities.

5.2.2 Water/Wastewater

Conclusion

The Mainside and EEA Ranges are generally in compliance with applicable water/wastewater program requirements. The only issues potentially affecting range sustainability include revision of the Stormwater Pollution Prevention Plan (SWP3) to include the results of the illicit discharge surveys and certification pages of the illicit discharge survey and to address the munitions buried at the Missile Test

Range to prevent potential releases to the PRTR, even though this would not constitute an off-range release.

Discussion

NSFD is located along approximately 4 miles of the southwestern shoreline of the Potomac River and is divided by the Upper Machodoc Creek into two areas, Mainside and EEA. Gambo Creek flows from northwest to southeast through NSFD, dividing the Mainside area into two tracts. Small unnamed tributaries to the Potomac River, Upper Machodoc Creek, and Gambo Creek also flow through NSFD. Two man-made freshwater impoundments, Hideaway Pond and Cooling Pond, are located within Mainside. The actual ranges are along the Potomac River and wetlands are in close proximity to the ranges (e.g., an unnamed wetland lies to the north of the OD Unit at EEA and Black Marsh is adjacent to the southern portion of the OB Unit at EEA). Any new actions or proposed projects at Dahlgren are coordinated with the NSFD/NAVFAC Natural Resources Manager to determine impacts to potential jurisdictional wetlands or United States waters, per Section 404 of the CWA.

NSFD has a SWP3 for their industrial areas that requires monitoring of runoff. This plan includes and addresses stormwater runoff from potential pollution areas within the ranges, including outfalls associated with gun mount operations and outfalls associated with the OB/OD operations. These outfalls are monitored quarterly or annually for petroleum hydrocarbons, copper, and/or total suspended solids. In addition, stormwater is analyzed yearly for metals, pesticides, base neutral extractables, volatiles, acid extractables, and miscellaneous constituents in the outfall associated with the OB/OD operations. No stormwater discharge permit limits have been exceeded in the past year. This SWP3 is currently in the process of being updated to reflect current roles and responsibilities. It is advised that revision of the SWP3 include the results of the illicit discharge surveys and certification pages of the illicit discharge survey as this documentation is not currently a part of the SWP3.

Wastewater that is generated at Mainside is treated by a Federally Owned Treatment Works (FOTW) that has recently undergone upgrades. This FOTW discharges into the Upper Machodoc Creek. Wastewater generated at EEA is not treated by the FOTW. This wastewater, which is generated from the administration building, is treated by a septic system behind the administration building.

During the site visit, it was noted that a previously unknown area of buried munitions and debris was exposed along the eastern shoreline of Mainside within the Missile Test Range due to past hurricanes and nor'easters. Large amounts of the shoreline were eroded and continue to erode. Metallic debris is being exposed through erosion processes along the shoreline and potentially could release munitions and MCs into the PRTR. It is advised that this area be addressed to prevent potential releases to the PRTR. Current efforts are focused at programming for shoreline repair utilizing Military Construction (MILCON) programming to prevent release of munitions.

5.2.3 Military Munitions/Solid Waste/Hazardous Materials/Hazardous Waste

Conclusion

NSFD currently is in compliance with hazardous waste management laws and regulations.

Discussion

NSFD participates in a Hazard Communication Program under the Hazardous Material Control and Management (HMCM) Program. NSFD meets Occupational Safety and Health Administration (OSHA) hazardous material regulatory requirements for the ranges by having an Authorized Users List and controlling access. Navy personnel manage hazardous material regulatory requirements for NSFD and conduct hazardous material management inspections.

Equipment has been tested for polychlorinated biphenyls (PCBs) and either replaced, removed, or substituted as appropriate. Generally, existing procedures appear to comply with hazardous materials and hazardous waste regulations. In addition, NSFD has not received any hazardous material management notices of violation (NOVs) as of the date of the RCA site visit in October 2006. As such, the NSWCDL-operated ranges are in compliance with hazardous material management regulations.

The MR, under RCRA, defines when conventional and chemical military munitions become solid wastes and when they are potentially subject to hazardous waste regulations. The MR also establishes procedures and management standards for waste military munitions (WMM). Navy personnel and contractors conduct range clearance and manage hazardous waste requirements for the NSWCDL-operated ranges. In addition, NSWCDL personnel conduct quarterly inspections at the magazines as a BMP. Through review of information and interviews with Navy personnel, NSWCDL-operated ranges are found to be in compliance with the MR.

The accepted, legal practice for disposal of WMM prior to the enactment of RCRA in 1980 was burial. After RDT&E of ordnance items, WMM were typically burned or detonated to render them safe. Burned WMM and MEC were then buried at NSFD. This practice was stopped prior to 1980 in accordance with RCRA. Through the Navy's Installation Restoration Program, all known or suspected past disposal areas were identified base-wide and are being addressed under CERCLA, including IR Sites 9 and 17. Occasionally, UXO (primarily inert) is inadvertently discovered at NSFD, from excavation activities, upheaving, or extensive shoreline erosion. This is not unexpected, as the property was used extensively as an aerial bombing target in the distant past. Upon discovery, the suspect item is marked and the on-site EOD team responds to investigate the item and render it safe if suspected/known to be live. As an ORC BMP, qualified ordnance personnel sweep the shoreline periodically and after storm events, to identify any suspect MECs. As aforementioned, EOD responds to any suspect item and takes appropriate action. Additionally, procedures are in place for the public to notify NSFD authorities if MEC is discovered off base, along the shoreline of the PRTR. Again, EOD responds to these notifications and removes the MEC.

The Navy's *Operational Range Clearance Policy for Navy Ranges* (Navy 2004b) includes requirements for activities such as the removal, disposal, and recycling of UXO, range scrap, and debris. Existing NSWCDL procedures comply with the operational range clearance policy.

5.2.4 Cultural Resources

Conclusion

The Mainside and EEA Ranges generally are in compliance with applicable cultural resource program requirements with the exception of noncompliance with U.S. Department of Defense Instruction (DODI) 4715.3, since the NSFD/NAVFAC has not finalized an ICRMP (anticipated early CY09).

Discussion

The Navy has a Cultural Resources Program Office at NSFD that implements Federal Historic Preservation requirements in accordance with NHPA Section 110, identification of historic and archaeological resources. Archaeological and architectural surveys have been conducted on the operational ranges to meet this requirement. A total of 18 archaeological sites have been documented and determined to be eligible for listing in the National Register of Historic Places (National Register). These sites are currently preserved in situ, and have not been formally listed in the National Register.

An environmental planning process, along with the NEPA process, is used to evaluate effects of any undertakings involving the identified archaeological sites, in accordance with NHPA Section 106 requirements. NSFD/NAVFAC is currently not compliant with DODI 4715.3; however, an ICRMP is underway and expected to be completed in 2009. The ICRMP will describe the management protocols developed to meet cultural resource regulations. It should be noted that there are no federally recognized Native American tribes in Virginia; however, the Virginia Council on Indians is involved in the determination of effect of an undertaking.

5.2.5 Natural Resources

Conclusion

The Mainside and EEA Ranges are generally in compliance with applicable natural resource program requirements.

Discussion

INRMPs describe the management protocols developed by the Navy to meet applicable natural resource regulations. The Sikes Act Improvement Act (SAIA) of 1997 committed the DOD and Navy to develop INRMPs by November 2001. In addition, DODI 4715.3 implements policy, assigns responsibilities, and prescribes procedures for the integrated management of natural and cultural resources on property under DOD control, including the preparation of INRMPs. The Navy, therefore, is obligated to prepare, maintain, and implement an INRMP that covers Dahlgren's active ranges. Dahlgren prepared an INRMP in October 2001 and updated the plan in November 2007. The Federal ESA protects species that are federally designated as threatened or endangered by prohibiting Federal actions from jeopardizing the continued existence of such species. Due to the recent delisting of the bald eagle in July 2007 (Federal Register (FR) 2007), there are currently no threatened and endangered (T&E) species identified at NSFD. However, the bald eagle continues to be protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. In addition, state and national guidelines identify specific protective measures to be taken around nests and foraging and roosting sites. The U.S. Fish and Wildlife Service (USFWS), in cooperation with the States, must monitor the status of species that have recovered and been delisted for at least 5 years. Thus, Dahlgren may be asked to cooperate in the post-delisting monitoring plan as discussed in the FR (Vol. 72, no. 130: 37373. July 7, 2007).

Typically, there are one to two nesting eagle pairs at the Mainside Ranges and three to four pairs at the EEA Range. As suitable habitat near NSFD continues to diminish due to development, there is potential for more bald eagles to reside at NSFD in the future. Annual eagle nesting aerial surveys are conducted by the College of William and Mary in cooperation with the Virginia Department of Game and Inland Fisheries (VDGIF). This, in conjunction with on-site surveys by the Natural Resources Office, will identify any new eagle nests within the Mainside and EEA Ranges. In addition, NSFD has prepared a Bald Eagle Management Plan (Geo-Marine 2007) and conducted an assessment of vulnerabilities of bald eagles to outdoor testing (Geo-Marine 2006). These activities will allow Dahlgren to provide data to USFWS if asked to cooperate in the post-delisting monitoring plan. Current land uses, including range activities, will not be negatively impacted by bald eagle nesting activities. However, consultation will be required if establishment of a new range is proposed in an existing bald eagle nest protective zone.

The Migratory Bird Treaty Act, its implementing regulations, and Executive Order (EO) 13186 protects migratory birds and their habitats through measures designed to, among other things, avoid and minimize impacts to migratory birds. NSFD occurs within the migratory flyway associated with the Chesapeake Bay. Increasing encroachment near the installation suggests that NSFD may become more attractive to migratory birds in the future and necessitate monitoring so that range operations are not affected.

The NSWCDL-operated ranges contain jurisdictional or potential jurisdictional wetlands/waters of the United States that fall under Section 404 of the CWA and other related regulations regarding wetlands. The Navy, therefore, is obliged to comply with these regulations. Wetland communities encompass more than 16 percent of the installation. The Navy considers wetland protection a top priority as reflected by their “No Net Loss” wetland policy. Dahlgren’s wetland protection policy is in strict compliance with Federal and state requirements and the Navy’s wetland policy. All proposed development activities are coordinated with the Natural Resources Manager early in the planning process to ensure that wetland issues are addressed. In addition, project-specific wetland delineations are conducted in accordance with the USACE Wetlands Delineation Manual on an as-needed basis for all proposed activities that could potentially require a Section 404 permit.

5.2.6 Emergency Planning and Community Right-to-Know Act

Conclusion

The Mainside and EEA Ranges are in compliance with EPCRA requirements. No issues affecting range sustainability were identified at either range.

Discussion

The primary purpose of EPCRA of 1986, otherwise known as the Superfund Amendments and Reauthorization Act (SARA) Title III, is to inform communities and citizens of chemical hazards in their areas. Sections 311 and 312 of EPCRA require businesses to report the locations and quantities of chemicals stored on-site to state and local governments in order to help communities prepare to respond to chemical spills and similar emergencies. Section 313 of EPCRA requires the U.S. Environmental Protection Agency (USEPA) and the states to annually collect data on releases and transfers of certain toxic chemicals from industrial facilities, and make the data available to the public in the Toxics Release Inventory (TRI). Hazardous materials under EPCRA also would be subject to state regulations. NSWCDL-operated ranges meet the requirement for reporting under Section 313.

The annual EPCRA reporting threshold has occasionally been met for lead, with contributions from munitions, primarily from OB/OD of explosive hazardous waste. A database with quantities of all of the munitions that are expended at EEA is maintained. This information is input into the TRI – Data Delivery System (DDS) to estimate quantities of EPCRA 313 constituents released by the treatment and/or use of these munitions. For activities that occur on the Mainside, the consumption of materials that are subject to EPCRA 313 reporting requirements is tracked by a Navy Hazardous Substance Management System (HSMS). All EPCRA 313 chemicals, such as lead, are compiled by the HSMS.

Sections 311, 312, and 313 of EPCRA apply to NSFD facilities that store, handle, and may potentially release hazardous and toxic chemicals including NSWCDL-operated ranges. Sections 311, 312, and 313 records have been registered with the local planning offices and/or with VDEQ. All of these records have been submitted prior to the required deadlines.

5.2.7 Environmental Planning

Conclusion

The Mainside and EEA Ranges are in compliance with applicable environmental planning requirements. The only issue potentially affecting range sustainability is off-range noise impact due to the growing population in the area surrounding NSFD. A comprehensive noise study will be conducted in conjunction with the NSWCDL EIS and draft submission is planned for early 2009. The study will determine the extent of off-range noise impacts in the vicinity of the upper, lower, and middle danger zones.

Discussion

Range operations have not changed significantly since the inception of NEPA in 1969; therefore, these activities were "grandfathered" under the NEPA program. The range operations at Dahlgren are in compliance with the requirements of the statutes, regulations, and instructions that govern most NEPA actions.

New substantial changes are documented through NEPA such as:

- Restrained Rocket Motor Firings, which receive categorical exclusions (CATEXes)
- Electromagnetic (EM) railgun facility (CATEX)
- Portions of the facility and/or operations that were re-aligned in the BRAC process were covered under an environmental assessment (EA) following each round of BRAC.

Any operations that require new buildings are evaluated through the NSFD for planning and design, which initiates the NEPA process for environmental review. Energetics, laser, or radiation projects are examples of activities that must also follow SOPs.

As a community awareness and public relations tool, the NSWCDL and NSFD work with the Public Information Working Group (PIWG), composed of representatives from the five counties surrounding the naval base at Dahlgren.

NSWCDL has several programs in place to address noise and reverberation concerns raised by members of the surrounding community associated with RDT&E activities. Multiple noise sensors are used to measure actual noise on the PRTR and the Sound Intensity Prediction System (SIPS) is used as a prediction model to make informed determinations as to whether firing should occur, based on local weather conditions and the predicted decibel level. SIPS is used to predict the noise levels at the muzzle, during flight, and at impact. However, sometimes noise complaints are issued for Dahlgren when they are in fact related to operations conducted at other military installations in the area (e.g., occurring on days when no gun firing occurs at NSWCDL-operated ranges).

At the current time, noise does not appear to be a risk for sustained operation of the land ranges; however, future development in the surrounding area could change the attitude of the community about noise. A comprehensive noise study will be conducted as a part of the NSWCDL EIS.

5.2.8 Range Environmental and Explosives Safety Management

Conclusion

The Mainside and EEA Ranges are in compliance with range environmental and explosives safety requirements.

Discussion

U.S. Department of Defense Directive (DODD) 4715.11, *Environmental and Explosives Safety Management on Department of Defense Active and Inactive Ranges Within the United States* applies to NSWCDL-operated ranges. In general, the Directive requires range managers to ensure the future sustainability of military ranges. The Directive includes requirements to ensure range sustainability related to explosives safety measures, UXO hazard notifications and education, assessment of environmental impacts of range operations, and working with the community to promote compatible land use around ranges.

The Navy acts within its explosives safety authority to manage UXO and MC through EOD sweeps and EOD response activities. In addition, appropriate action has been taken to prevent unauthorized access to the base and PRTR during testing, through posted U.S. Government property signs, UXO hazard warning signs, codified restrictions for public use of the PRTR and special use airspace in the federal register, and established security patrols.

Encroachment due to urban or residential development is becoming more of an issue for the naval base at Dahlgren and is an area where the host installation, NAVFAC, NSWCDL, and other tenants must proactively work together to identify encroachment challenges and develop management strategies. NSWCDL and NSFD should be commended for the proactive approach through positive community outreach and participation in the PIWG, which is composed of representatives from the five counties surrounding the base. All commands located at Dahlgren must work cohesively to identify and capitalize on opportunities to secure and retain public support for the naval base.

Encroachment challenges widely recognized by the Navy, applicable to NSFD and NSWC-operated ranges, include:

- Population growth
- Competition for air space, land, and water range use
- Competition for utilities (electrical power)
- Increase in bald eagle nesting sites
- Maritime issues
- Safety arcs and footprints
- Water quality
- Transportation impacts, and
- Interpretation of Historical/Environmental regulations, CZMA, Fish and Wildlife Coordination Act, and Migratory Bird Treaty Act.

Potential RDT&E mission impacts from these encroachment challenges include:

- Creation of temporary or permanent avoidance areas
- Reduction in usage days
- Prohibition of certain testing events
- Reduction in range access
- Segmentation of RDT&E and reduction in realism
- Limitations on use of new technologies
- Restrictions on flight altitudes and/or airspeeds
- Restrictions on night and all weather operations
- Reductions in live fire RDT&E, and
- Increases in costs or risks.

5.2.9 Installation Restoration/Munitions Response

Conclusion

The Mainside and EEA Ranges are in compliance with applicable IRP requirements. The potential issues affecting range sustainability identified include continued erosion of the shoreline and the limited distribution of MC in the environment. The Navy is presently addressing the shoreline erosion problem by providing signage, performing periodic shoreline sweeps by EOD, developing shoreline stabilization design, and in the future, stabilizing the shoreline. The Navy is presently addressing the MC issue at the OB/OD site in coordination with VDEQ.

Discussion

The IRP was established by DOD in 1975 to identify, assess, characterize, and remediate chemical contamination or site conditions resulting from historical disposal activities and other operations at military installations. The Navy IRP was formally established in 1986 and is implemented in accordance with Federal, state, and local laws. The primary Federal laws are CERCLA, SARA, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and RCRA. Because of the nature of military activities on DOD installations, IRP studies commonly include UXO and MCs. Dahlgren was proposed for the USEPA National Priorities List (NPL) on 7 February 1992, and was formally added to the NPL on 14 October 1992. A Federal Facility Agreement (FFA) was enacted between the Department of the Navy, USEPA Region 3, and the Commonwealth of Virginia in September 1994. The FFA established the procedural framework and schedule for investigations at Dahlgren, including the development, implementation, and monitoring of appropriate response actions at sites located on the base. The FFA categorized 42 sites to be further investigated and characterized ("Appendix A Sites"), and identified 33 site areas requiring additional documentation or sampling before a no further action (NFA) designation was warranted ("Appendix B Sites").

The Dahlgren IRP has an informal goal to achieve delisting from the NPL by 2010. As such, the program has proactively investigated FFA sites across all ranges of the installation achieving closure or NFA determinations for approximately 70 percent of the identified sites. The remaining site areas are in various stages of the CERCLA or RCRA process. RDT&E operations on the active, land-based test ranges at the NSFD are not impeded or inhibited over the long term by ongoing investigative or rehabilitation activities and extensive coordination exists between the testing and IR components. The IR sites are actively being brought into compliance with environmental regulations in cooperation with the VDEQ and USEPA Region III. Figure 5-1 shows the locations of IR sites, RCRA solid waste management units (SWMUs), and areas of concern (AOCs) (Navy 2006c). Appendix D documents decisions made during the project planning and scoping process and includes a schedule and proposed actions for all CERCLA responses, specific RCRA corrective actions and outlines all response activities and associated documentation under the FFA, to be undertaken at the installation.

Community relations activities are proactive and ongoing throughout the testing and IR process at NSFD. A Technical Review Committee established in 1992, including two representatives from the public, made up the predecessor to the Restoration Advisory Board (RAB), which was formalized in October 1994. A Community Relations Plan outlining Dahlgren's program to provide communication and information exchange opportunities was updated in June 2004 (Earth Tech Inc 2004). NSFD/NAVFAC regularly participates in partnering meetings with USEPA and VDEQ and these

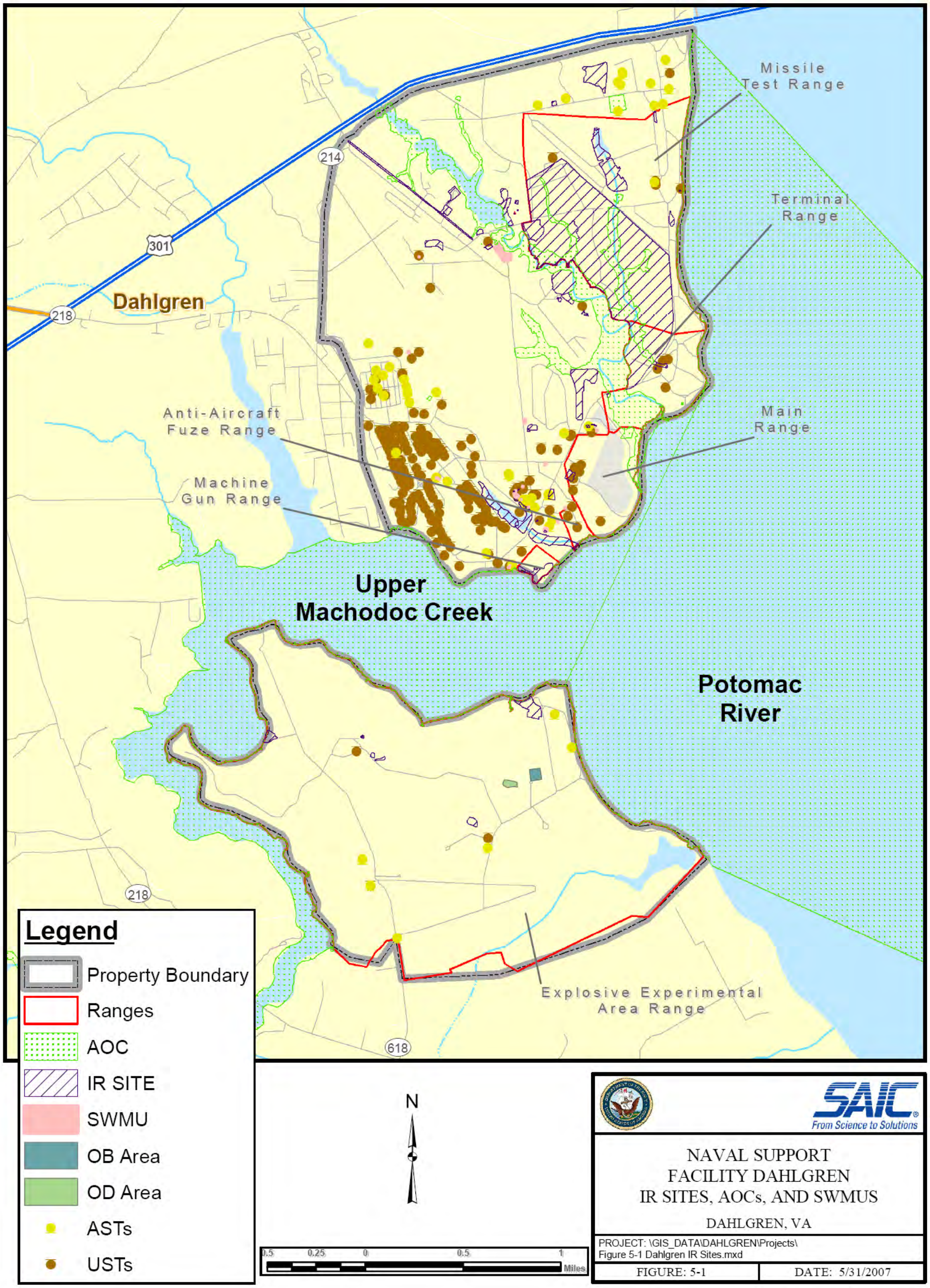


FIGURE 5-1. NAVAL SUPPORT FACILITY DAHLGREN IR SITES, AOCs, AND SWMUs

agencies meet jointly with the RAB on a biannual basis, although public attendance is generally regarded as sparse. Dahlgren outreach maintains contact with the public through the RAB, operation of an informational website (http://www.nswc.navy.mil/), and community interaction through a Public Affairs Office (PAO) liaison. Requests from the public are directed to responsible individuals in the appropriate departments or are managed by the PAO liaison. Table 5-1 summarizes the size and status of each IR site located on the operational ranges and sites with MCs. The table also identifies within which range the location of each IR site.

A Public Health Assessment (PHA) was completed by the Agency for Toxic Substances and Disease Registry (ATSDR) pursuant to CERCLA or Superfund Section 104 (i)(6) (42 USC 9604 (i)(6)), and in accordance with 42 Code of Federal Regulations (CFR) Part 90 (ATSDR 2006). ATSDR completed the assessment using relevant health data, environmental data, and community health concerns obtained from USEPA, state and local health and environmental agencies, the community, and potentially responsible parties to document potential risks to human health. ATSDR examined the nature and extent of environmental contamination resulting from previous material handling and disposal practices at Dahlgren to evaluate the potential exposure of on-base residents, visitors, employees, and local community members.

As a result of the PHA, ATSDR and regulatory agencies concluded that environmental contamination at Dahlgren posed no apparent public health hazard citing that people may be exposed to small amounts of environmental contaminants on-base, but at levels not expected to cause harmful health effects. Despite the presence of numerous areas of concern on the naval base, the Navy is proactively addressing these areas under range management efforts, and the IR and RCRA programs.

As a prudent public health action, ATSDR recommended that hunters and anglers follow the guidance issued by the Commonwealth of Virginia and the base regarding fish and game consumption restrictions and advisories, and that people who wish to swim in the Potomac River use established beach areas associated with public parks and follow all posted regulations.

There have been no NOVs or work stoppages issued for either Mainside or EEA with regard to IR regulatory requirements. Occurrences of munitions on active and inactive ranges may pose land use issues for test area expansion; however, once identified, they are addressed appropriately. The predominant groundwater flow direction on Mainside and EEA is toward the PRTR area and Upper Machodoc Creek. Shallow groundwater affected by site activity is not utilized as a drinking water source by the installation and the surrounding community is predominantly upgradient of the installation; therefore, groundwater quality in privately owned shallow (2 to 20 feet below land surface [BLS]) wells (if any exist in the surficial Columbia aquifer) is unlikely to be affected by range activities. NSFD/NAVFAC has initiated remedial actions at a large proportion of the investigated site areas with the goal of eliminating contaminant sources. This proactive approach complies with regulations governing the IR process and should prevent CWA compliance deficiencies for NSFD. NSWCDL is proactively investigating and addressing MC-related issues in coordination with VDEQ at the OB/OD units.

5.2.10 Storage Tank Management and POL Management

Conclusion

Tank and POL management on the active, land-based test ranges at NSFD are generally in compliance with applicable regulatory requirements. No NOVs have been issued for NSFD relating to tank storage or POL deficiencies as of the time that the RCA on-site interviews were conducted in October 2006. The existing Spill Prevention Control and Countermeasures (SPCC) plan is being updated/revised by NSFD/NAVFAC and will be finalized on or before 1 July 2009 in accordance with 40 CFR 112. The NSFD's existing Oil Discharge Contingency Plan (ODCP), dated 25 January 2001, is out of compliance since the plan expired on 10 January 2005, and is being updated at the time of this writing.

TABLE 5-1. SUMMARY OF NSFD IR SITES (AS OF OCTOBER 2006)

Site	Range Location	Area (acres)	Site	Status*
IR Site 1	Missile Test Range	253.96	Old Bombing Range	Deferred Action Until Range Closure
IR Site 2	Missile Test Range	4.70	Fenced Ordnance Burial Area	Record of Decision (ROD)-Remedial Action complete; Long-Term Monitoring (LTM)
IR Site 3	Mainside	0.021	Ordnance Burn Structure	NFA
IR Site 4	Mainside	2.54	Case Storage Area	Site Screening Process Report (SSPR); Engineering Evaluation/Cost Analysis (EE/CA); Remedial Action underway
IR Site 5	Terminal Range	0.82	Projectile Disposal Area	Deferred Action Until Range Closure
IR Site 6	Mainside	2.34	Terminal Range Airplane Dump	ROD; monitoring
IR Site 9	Mainside	7.91	Disposal/Burn Area	ROD; LTM; wetland monitoring
IR Site 10	Missile Test Range	12.49	Hideaway Pond	ROD; LTM
IR Site 12	Mainside	0.18	Chemical Burn Pit	Addendum ROD underway; Remedial Action completed
IR Site 13	Mainside	0.41	Gambo Creek Truck Wash Area	NFA
IR Site 14	Mainside	0.38	Chemical Warfare (CW) Evaporation Pond	Site Screening Process (SSP); EE/CA
IR Site 15	Mainside	2.54	Scrap Metal Storage Area	SSP; EE/CA; Removal Action underway
IR Site 17	Mainside	7.58	1400 Area Landfill	ROD; LTM
IR Site 25	AA Fuze Range	6.62	Pesticide Rinse Area	Remedial Action Completed; wetland monitoring
IR Site 31	EEA	1.59	Airplane Park Dump	NFA
IR Site 32	EEA	1.10	Fast Cook-Off Pit And Pond	NFA
IR Site 33	EEA	0.32	Otto Fuel Spill	Closed
IR Site 36 (also AOC C1)	EEA	0.27	Depleted Uranium (DU) Mound EEA Mixed Waste	NFA
IR Site 37	Machine Gun Range	4.19	Lead Contamination Area	Closed
IR Site 39	Main Range	1.16	Open Storage Area Main Battery	Closed
IR Site 43	Missile Test Range	0.39	Higley Road Land Application	NFA
IR Site 44	Mainside	0.03	Rocket Motor Pit	NFA

TABLE 5-1. SUMMARY OF NSFD IR SITES (AS OF OCTOBER 2006) (CONTINUED)

Site	Range Location	Area (acres)	Site	Status*
IR Site 45	Mainside	2.14	Landfill B	NFA
IR Site 46	Missile Test Range	1.87	Landfill A: Stump Dump Road	Remedial Action completed; wetland monitoring
IR Site 47A	Missile Test Range	0.63	World War I Munitions Mound	EE/CA Removal Action complete
IR Site 47B	Missile Test Range	0.01	Barbette/DU Contamination	EE/CA Removal Action complete
IR Site 49 (also AOC C4)	Machine Gun Range	0.06	Building 200 DU	NFA
IR Site 50	EEA	4.55	Fill Areas Northeast EEA (Objects)	NFA
IR Site 57	Mainside	1.87	Shell House Dump	SSP complete
IR Site 58	Mainside	1.01	Building 1350 Landfill	ROD – Remedial Action complete
IR Site 59	EEA	0.09	Octagon Pad Dump	Closed
IR Site 61A	Mainside	2.13	Gambo Creek Ash Dump	Remedial Investigation/Feasibility Study (RI/FS) complete; SSP complete
IR Site 61B	Terminal Range	0.18	Gambo Creek Projectile Disposal	Closed
IR Site 62	Mainside	0.04	Building 396	RI/FS; ROD – Remedial Action complete
AOC Q	PRTR	1,305.65	Machodoc Creek	Closed
Other Units C3	Main Range	1.58	Scar At Phalanx Test Area	Closed
IR Site 60	EEA	0.012	Building 445 Star Gauge Loading	Closed
Located on Active Range	Terminal Range	0.04	Terminal Range Building 109	Closed
AOC P	Missile Test Range	224.23	Gambo Creek	Phase II complete

* The terms NFA and Closed are interchangeable. No additional characterization, assessment, or responses are required for closed sites or sites listed with NFA as the status.

Discussion

NSFD/NAVFAC manages underground storage tank (UST) and aboveground storage tank (AST) assets and POL regulatory requirements on the Mainside and EEA Ranges. The current Tank Management Plan (TMP) (NSWC 2003), as required under OPNAVINST 5090.1C, extends to the operational ranges. Applicable regulations for storage tanks on the active NSWCDL-operated ranges, OPNAVINST 5090.1C, Oil Pollution Prevention Regulation of 1973 (OPP), Oil Pollution Act of 1990 (OPA90), and OSHA regulatory requirements, are met for the ranges and no deficiencies have been noted. No known tank-related NOVs have been issued through the time of the RCA site visit in October 2006. An SPCC and TMP (NSWC 2003) containing information relevant to the Spill Contingency Plan (SCP) and the Facility Response Plan (FRP) are in place for the NSWCDL-operated ranges. NSFD's ODCP expired on 10 January 2005, and is therefore noncompliant with State Water Control Law 62.1-44.34:15 and Virginia Regulation 9 Virginia Administrative Code (VAC) 25-91-10 et seq. An updated ODCP is anticipated to be finalized in early 2009.

NSFD's USTs are Underwriter's Laboratory (UL) approved tanks. Tanks meet Virginia UST regulatory requirements (9 VAC 25-580) and Federal UST regulatory requirements (40 CFR 280) for leak detection, secondary containment, and corrosion protection. An UST removal and replacement project, completed in the summer of 1992, replaced regulated USTs and several heating oil tanks to meet Virginia and Federal UST regulatory requirements. NSFD/NAVFAC performs release detection monitoring by groundwater monitoring on older USTs, interstitial monitoring by liquid-level sensing on newly installed (1991 or later) USTs, and by visual inspection of ASTs and petroleum product storage locations. Alarm systems for interstitial monitoring have been installed for 19 USTs at 16 locations. The tanks are double-walled and tested annually.

Based on interviews with personnel active in the tank and POL management and records provided by NSFD/NAVFAC, there have been no historical off-range releases from USTs or ASTs. Further, USTs and ASTs removed from NSFD have achieved closure under the State of Virginia regulatory process. Tank areas requiring additional assessment were investigated and remediated.

ASTs are visually monitored by employees and the SPCC Plan Coordinator on a regular basis. ASTs are either double-wall construction, located in secondary containment structures, or are within buildings. Drum storage areas have secondary spill containment that is adequate to prevent the release of oil to navigable waterways. Drums are stored without direct ground contact (i.e., on pallets or platforms) such that all sides of the drums are visible. ASTs have been tested and 25-year certified (NSFD/NAVFAC personal communication 2006).

Petroleum products are delivered to NSFD via vendor-provided transport and equipment. No. 2 fuel oil, gasoline, diesel fuel, and kerosene are transferred directly from the vendor transport to the appropriate UST or AST. Lubricating oils, hydraulic oils, transmission fluids, motor oils, and greases are delivered in 55-gallon drums, 5-gallon containers, or consumer-size packages. When vessels are fueled at the docks of the Yardcraft area, personnel are prepared to utilize emergency containment booms to prevent a potential spill from spreading away from the immediate dock area.

5.2.11 Safe Drinking Water

Conclusion

The Mainside and EEA Ranges are in compliance with applicable safe drinking water requirements. It is advised that NSFD update the Operations and Maintenance Plan. No munitions constituents have been detected in the drinking water source for Mainside or EEA. However, it should be noted that perchlorate and RDX were detected at EEA in the surficial aquifer, approximately 2 to 20 feet BLS. This surficial aquifer is not a drinking water source.

Discussion

SDWA applies to and regulates drinking water sources and public water systems for the purpose of ensuring safe drinking water. Deep water wells draw water from a confined aquifer 780 feet BLS on the property to provide a potable water source in support of the military mission and personnel throughout the installation. The aquifer from which the drinking water is drawn is a part of the Potomac Group Artesian aquifer, which is a series of aquifers. The aquifer is composed of three aquifers and confining units that are collectively labeled the Potomac Formation. The productive aquifer the base drinking water supply is collected from is very deep (between 700 and 800 feet BLS). The aquifer that overlays the drinking water supply aquifer is approximately 116 to 123 feet BLS and is separated from the deeper aquifer by a large clay lens. Three wells supply approximately 5,600 individuals at the Mainside area, which is a community public water supply system. One well supplies less than 25 individuals in the administration building of EEA. This water system is considered noncommunity transient.

Water is treated by a chlorine injection system prior to distribution to the community (Mainside) and noncommunity transient (EEA) systems. No NOVs related to contaminants in water have been issued for the public water supply in the past year and current plans are in place to prevent cross connection control problems and backflow. A NOV was issued to NSFD in February 2007 for failing to meet the sampling deadline, but corrective action has been taken to prevent scheduling concerns in the future. The Operation and Maintenance Plan needs to be updated by NSFD to address such items as deleting text regarding a new well that is no longer in use and incorporating wells that have been added since the plan was drafted.

Perchlorate and RDX were detected in the shallow groundwater wells at EEA. There is currently no Federal or state maximum contaminant level (MCL) for perchlorate or RDX. Both constituents are being closely monitored by NSWCDL as required by the RCRA Permit for the Thermal Treatment of Hazardous Waste by OB/OD. A GPS for perchlorate in groundwater at the OB/OD has been established by VDEQ for Dahlgren.

Perchlorate analyses have been conducted at Dahlgren since 2001 progressively using Solid Waste (SW) 846 Methods 8321A and 8270C and USEPA drinking water Methods 314.0 and, most recently, 332.0. Perchlorate is not specifically regulated by Virginia water quality regulations administered by VDEQ or the Virginia Drinking Water Regulations administered by the Virginia Department of Health. There currently are no proposals to regulate perchlorate in Virginia (VDEQ 2007). Section 5.3.3.7 provides additional information concerning groundwater and surface water quality.

A summary of the results of the perchlorate data is made available to the public yearly (DOD 2007). Although perchlorate and RDX have not been detected in the drinking water, it is advised that the NSFD safe drinking water managers continue to be aware of the perchlorate and RDX results of future sampling events and detections of perchlorate and RDX in the shallow groundwater at EEA.

5.2.12 Range Encroachment

Conclusion

NSFD, NAVFAC, and NSWCDL are working together to address designated actions identified in the Encroachment Action Plan (NAVFAC 2007b) to sustain range operations. Additionally, Encroachment Management and Encroachment Partnering Programs, as defined in OPNAVINST 11010.40, should be established by NSWCDL to ensure operational RDT&E mission sustainment.

Discussion

Encroachment represents perhaps the most time-critical threat to range sustainability, particularly for range areas existing in proximity to civilian populations and co-utilized resources. For these areas, population growth and civilian expansion strains resource and land use needs proportional to growth while concurrently inhibiting range activity or expansion. Range encroachment encompasses any non-Navy action that inhibits, curtails, or possesses the potential to impede the performance of the Navy mission (CNO 2006). The CNO Encroachment Management program is mandated in OPNAVINST 11010.40 (CNO 2006) to sustain Navy installations, RDT&E ranges, air, and water operations areas (OPAREAs), special use airspace (SUA), and military training routes (MTRs). Encroachment Partnering (EP) is a land acquisition authority (CNO 2006) specifically enacted to reduce or eliminate current or potential encroachment by acquiring buffer zones to prevent incompatible land uses and preserve off-base habitat to relieve current or avoid future environmental restrictions on operations. Because public involvement is a key component of EP, NSWCDL operates an Internet site (http://www.nswc.navy.mil/RANGE/) to promote public awareness of test firings and mission activities.

NSWCDL is developing and implementing practices that identify and address encroachment challenges, ensure the availability of facilities and operating areas, create collaborative relations with external parties, and maintain capabilities necessary to ensure continued mission execution. This will be accomplished by developing relationships with external parties, promoting employee awareness, and involving host and other tenant commands in NSWCDD's sustainability planning.

Encroachment due to urban or residential development is becoming more of an issue for the naval base at Dahlgren and is an area where the host installation, NAVFAC, NSWCDL, and other tenants must proactively work together to identify encroachment challenges and develop management strategies. NSWCDL and NSFD should be commended for the proactive approach through positive community outreach and participation in the PIWG, which is composed of representatives from the five counties surrounding the base. All commands located at Dahlgren must work cohesively to identify and capitalize on opportunities to secure and retain public support for the naval base.

Encroachment challenges widely recognized by the Navy, applicable to NSFD and NSWCDL-operated ranges, include:

- Population growth
- Competition for air space, land, and water range use
- Competition for utilities (electrical power)
- Increase in bald eagle nesting sites
- Maritime issues
- Safety arcs and footprints
- Water quality
- Transportation impacts, and
- Interpretation of Historical/Environmental regulations, CZMA, Fish and Wildlife Coordination Act, and Migratory Bird Treaty Act.

Potential RDT&E mission impacts from these encroachment pressures include:

- Creation of temporary or permanent avoidance areas
- Reduction in usage days
- Prohibition of certain testing events
- Reduction in range access
- Segmentation of RDT&E and reduction in realism
- Limitations on use of new technologies
- Restrictions on flight altitudes and/or airspeeds
- Restrictions on night and all weather operations
- Reductions in live fire RDT&E, and
- Increases in costs or risks.

A strong commitment to encroachment management will help ensure long-term sustainability of the Navy's RDT&E mission at NSFD.

5.3 OPERATIONAL RANGE SITE MODELS

This section presents the ORSMs for land-based NSWCDL-operated ranges. Section 5.3.1 describes the areas where munitions are handled, stored, and used for testing at NSWCDL-operated ranges. Section 5.3.2 describes the operational component of the ORSMs. The environmental and land use components are described in Sections 5.3.3 and 5.3.4, respectively. The completed ORSMs for Mainside and EEA Ranges are described in Section 5.3.5.

5.3.1 Definition of Ranges

The purpose of defining ranges in RSEPA is to identify areas where MCs could potentially migrate off range and potentially pose risks to human health and/or ecological receptors. Therefore, RSEPA focuses on land-based ranges and components of ranges on land where munitions RDT&E operations are conducted. These areas are also described in this section.

ORSMs are used to determine where munitions operations occur on land (operational component), what environmental conditions are found in and around those areas (environmental component), and what land uses are in and around these areas that could pose potential risks to humans or ecological receptors exposed to residues of the munitions operations (land use component). ORSMs are used to determine where additional analysis (e.g., predictive modeling, protective measures) is needed to assess or address the risk of off-range releases of MCs. The Technical Team looked for locations where munitions are or were handled, stored, or used for RDT&E activities at NSWCDL-operated ranges. Table 5-2 summarizes munitions-related activities occurring within the NSWCDL-operated ranges. Figure 5-2 shows the locations where these munitions-related activities occurred.

5.3.2 Operational Component

This section summarizes information about land-based operations, particularly where operations utilizing munitions are or were conducted. The following sections describe past, current, and planned future uses, respectively, of Mainside and EEA Ranges.

TABLE 5-2. SUMMARY OF MUNITIONS-RELATED ACTIVITIES OCCURRING AT NSWCDL-OPERATED RANGES

Munitions-Related Activity	Primary Source	Location
Munitions Handling and Storage	*Transfer Points* – Areas where munitions shipments occur	• Mainside – Shellhouse • Mainside and EEA – Piers
	Storage Magazines/Ammunition Supply Points – Areas where munitions storage and/or issuance occurs	• Various magazine areas on Mainside and EEA
Weapons Testing and Training	*Firing Points* – Areas where weapons systems are placed for testing and training, including mobile systems (e.g., truck-mounted systems)	• Missile Test Range (tiedown pad) – Up to 6-inch projectiles were fired at armor plates, berms, and concrete blocks and into PRTR; missiles no longer fired from here • Terminal Range – 3- to 16-inch projectiles and smooth bore items fired at armor plates, berms, and concrete blocks; some fired into PRTR; 16-inch guns no longer used • Main Range – 20-mm to 16-inch projectiles fired from 42 gun emplacements into PRTR; 16-inch guns no longer used • Machine Gun Range – 40-mm and smaller projectiles (with a spot for a 3-inch gun) used to test armor; all projectiles are collected in sand-filled backstops or fired into the PRTR
	Impact/Target Areas – Areas targeted by weapons systems	• See firing points for locations where nonexplosive projectiles are fired at armor plates, berms, and concrete blocks • Munitions, mostly inert, have been fired into PRTR since 1918
	Buffer Zones – The area on ranges extending beyond impact areas to provide safety zones to contain ricochets, blasts, and fragmentation from exploding munitions The Danger Zones are not buffer zones but impact areas	• The PRTR includes an upper, middle, and lower danger zone (33 CFR 334.230[a]) • Restricted Airspace R-6611 (subareas A and B), R-6612, and R-6613 (subareas A and B) have been established to prevent hazards to aircraft from projectiles or fragments during tests being conducted at NSWCDL-operated ranges • ESQD arcs are calculated and established for each operation on each range
	Environmental Testing Areas – Areas where munitions and munitions parts are tested under induced and simulated environments of shock, vibration, acceleration, temperature, humidity, and drop	• AA Fuze Range – Test firings of explosive-loaded and fuzed projectiles up to 8 inches; include gun barrel testing during malfunction investigations • EEA Range – Specially equipped facility for fast and slow cookoff tests, shock tests, environmental exposure tests, drop and vibration tests, rocket penetration tests, and blast and fragmentation tests

TABLE 5-2. SUMMARY OF MUNITIONS-RELATED ACTIVITIES OCCURRING AT NSWCDL-OPERATED RANGES (CONTINUED)

Munitions-Related Activity	Primary Source	Location
Troop Training	*Combat Range* – Areas used for combat maneuvers	Not applicable
	Bivouac and Encampment Areas – Troop living areas (bivouacs are short-term areas, encampments are long-term, more permanent installations)	Not applicable
Defensive Positions	*Minefields* – Areas containing buried or surface placed anti-personnel or anti-tank mines	Not applicable
	Gun Emplacements – Areas where defensive weapons (e.g., anti-aircraft guns) are located	Not applicable
Sanctioned and Unsanctioned Munitions Disposal	*Mass Burial/Landfills with Munitions* – Areas where quantities of munitions were abandoned in place or disposed of by burial, prior to 1980.	• Missile Test Range – Fenced Ordnance Burial Area (IR Site 2), World War I Munitions Mound (IR Site 47A) • Terminal Range – Projectile Disposal Area (IR Site 5) and Gambo Creek Projectile Disposal (IR Site 61B) • Not Located on Operational Ranges – Disposal/Burn Area (IR Site 9, west of Missile Test Range), 1400 Area Landfill (IR Site 17, north of Missile Test Range), Rocket Motor Pit (IR Site 44, west of Missile Test Range), and Shell House Dump (IR Site 57, west of Missile Test Range)
	Open Burn/Open Detonation (OB/OD) – Areas where ordnance was consolidated and treated by either burning or detonation	• EEA Range – RCRA Permit for the Thermal Treatment of Explosive Hazardous Waste by OB/OD • Located on Inactive Operational Ranges – Burn Area (IR Site 3/44)
	Bomb Jettison Area – Areas where bombers jettison bombs prior to landing	Not applicable

FIGURE 5-2. NAVAL SUPPORT FACILITY DAHLGREN LOCATIONS OF MUNITIONS-RELATED ACTIVITIES

5.3.2.1 Historical Military Operations

Through the years of RDT&E operations at Dahlgren, high explosives such as TNT and RDX have been used as well as smokeless powder, black powder, solid propellants, and liquid propellants such as hydrazine and red fuming nitric acid (Navy 1983b). Some of these operations could have resulted in residual MC contamination. This section describes the potential sources of MCs resulting from historical military operations and measures the Navy has taken to characterize and address these concerns.

NSWCDL RDT&E operations with MCs were used throughout NSFD. The *Initial Assessment Study (IAS) of Naval Surface Weapons Center, Dahlgren Laboratory, Dahlgren, Virginia* (Navy 1983b) included an on-site survey, historical records review, aerial photograph review, field inspections, and personal interviews "…to identify and assess sites posing a potential threat to human health and the environment due to contamination from past hazardous materials operations." The IAS identified 36 potentially contaminated sites and recommended further investigation at 7 sites under the Navy Assessment and Control of Installation Pollutants (NACIP) program. Results of the confirmation study for the first sites were included in the *NACIP Final Report, Confirmation Studies at the Naval Surface Weapons Center* (Navy 1986). These confirmed sites, as well as the remaining sites, were later transferred to the Navy's IRP, which is the successor to the NACIP program.

USEPA Region 3 conducted a visual site inspection (VSI) under the auspices of their RCRA Corrective Action Program in August 1992. The VSI resulted in designating 129 SWMUs, 26 AOCs, and 5 other units to the RCRA Corrective Action Program. As a result of a subsequent analysis of aerial photographs, USEPA later designated six additional SWMUs (Navy 2006c).

When USEPA evaluated Dahlgren using the Hazard Ranking System (HRS), the facility scored greater than the 28.5 needed to rank on the NPL (Navy 2006c). Consequently, the naval base at Dahlgren was added to the NPL on 14 October 1992. An FFA (Navy 1994) was signed by USEPA Region 3, the Commonwealth of Virginia, and the Department of Navy on 30 September 1994. The FFA listed and prioritized all of the IR sites and RCRA Corrective Action SWMUs and AOCs identified for cleanup, including the following sites with potential MC-related concerns: Sites 1 through 6, 9, 12 through 15, 17, 25, 31 through 33, 36, 37, 39, 43 through 47, 49, 50, 57 through 59, 61 (A and B), 62, AOC Q, Other Units C3, and AOC P.

NSFD has worked with VDEQ and USEPA to aggressively investigate, remediate, monitor, and/or bring to closure the identified IR sites, SWMUs, and AOCs, and is seeking to be delisted from the NPL by 2010. The status of the IR sites, SWMUs, and AOCs located on operational ranges is shown in Table 5-1 (Navy 2006c). The 2008 Site Management Plan is provided in Appendix D. The remaining discussions focus on munitions sites where a ROD has not been signed or the remedial action is not underway or complete. Areas where special use munitions including CW and DU were used, as well as where DMM sites have been discovered, also are discussed.

UXO and DMM are not typically addressed under the IRP except where incidentally encountered during investigations. At NSFD, this has been the norm rather than the exception for sites listed in Table 5-1. As a result, UXO and DMM contamination have been broadly addressed. However, two sites, IR Site 1 (Old Bombing Range), comprising roughly half of the active Missile Test Range, and IR Site 5 (Projectile Disposal Area) on the Terminal Range received a recommendation to defer action (NAVFAC 2007a) until the ranges are closed or transferred (provided in Appendix D).

Munitions have been expended in quantities estimated to be as high as 1.6 million pounds per year (Navy 1983b). Munitions impacting the Potomac River are rarely recovered. However, it should be noted that no live munitions were fired into the PRTR before World War II and only a small percentage of the rounds fired into the PRTR in any calendar year are HE rounds.

Portions of the Mainside and EEA Ranges were used for air-to-ground bombing during World War II. Historical records reference aerial bombing, but do not provide details concerning the quantities, types, and frequencies of the bombing. Records indicate that a “bombing pad” was constructed in 1941 or 1942 within presently designated Main Range boundaries. A 1930 vintage base map shows a “bombing field” that also would have been located within and/or near the Main Range. In addition, a bombing target was built within the Potomac River in 1943. Aerial photographs from 1943 also show what is thought to be a target complex in or near the area of the bombing field and small bomb craters surrounding what may be the bombing pad. In approximately 1946, an “octagon bombing slab” (IR Site 8) was constructed in EEA.

Reports indicate minimal potential for low-level radiation residue historically associated with munitions and ranges. These sites were addressed as follows:

- A large metal structure formerly located near Building 170A (IR Site 34 – Barbette/DU Contamination) was contaminated with DU. Detectable radiation was measured at the crack between the top of the cylinder and the 4-inch cover plate; however, no residual radiation remains (NSWC 2007). The structure was shipped to a permitted facility between 1990 and 1992 (Navy 1992).
- Approximately 200 pounds of thorium-magnesium (misch metal) rods were stored in a trailer near Building 370 (IR Site 35 – Thorium/Magnesium Misch Metal Storage). Misch metal containing less than 4 percent (by weight) of thorium is exempt from U.S. Nuclear Regulatory Commission (NRC) regulations, but industrial operations involving physical or chemical processing of misch metal must be reviewed and licensed by NRC to ensure proper application of regulatory controls. The misch metal contained 2 percent thorium; therefore, it was considered exempt and was properly disposed.
- The DU Mound (IR Site 36, also known as USEPA AOC C1) was located in the EEA, in the Harris Range. It was approximately 80 feet in diameter and 12 feet high. The site was a grass-covered pile of earth where rounds of 20-mm DU shells were imbedded from testing trajectories. The site began operation sometime in the 1970s and was active until 1990. DU penetrators and contaminated soil were removed from Site 36 and placed in 55-gallon drums. Once confirmation sample results were received, the drums were shipped to a permitted facility and the remaining uncontaminated soil was leveled to grade. In January 2002, NRC transmitted a letter indicating that Site 36 met the criteria for unrestricted use described in 10 CFR 20.1402 (Navy 2006c).
- The DU Gun Butt (IR Site 49, also known as USEPA AOC C4) was located east of Building 200. It was an open steel sand butt used to test DU shells. The butt was designed so that fired shells expended their energy in the sand. A portion of the shell was pulverized or abraded on impact, resulting in a dust of metal and pulverized sand. The butt began use in the 1940s and ceased use prior to July 1991. The butt consisted of a large steel rectangular box (24 feet wide by 51 feet deep and 15 feet high) with a vertical open face containing approximately 13,000 cubic feet of sand and approximately 3,500 DU shells. The butt was constructed of steel armor plate approximately 4 inches thick. In June 1998, the DU gun butt decontamination and removal occurred (NSWC 2007). Confirmatory samples indicated that cleanup goals were achieved. In January 2002, NRC transmitted a letter indicating that Site 49 met the criteria for unrestricted use described in 10 CFR 20.1402 (Navy 2006c).

Occasional exposure of munitions-related debris in a bluff on the eastern shore of the Missile Test Range has been informally designated as the Old Plate Battery Test Area, based on historical testing conducted in this area. This stretch of shoreline has undergone extensive erosion through severe storm action, most notably Hurricane Isabel in 2003. Several MEC items were visible in the eroded bank after hurricane Isabel and are indicative of past operations in the area. This area was deemed ineligible for investigation within the IRP (as only MEC and scrap metal have been identified) and Munitions Response Program (MRP, as the site is on an active range). As an ORC BMP, qualified ordnance personnel routinely sweep the beach area for munitions and components following storm events. EOD personnel are then contacted to take appropriate actions for any items of concern. To date, only one suspect MEC has been found through seven quarterly sweeps. The Navy is presently addressing this area by providing signage, continuing periodic shoreline sweeps, developing shoreline stabilization design, and in the future, stabilizing the shoreline. Additional sites associated with munitions burial are summarized in Table 5-3.

During on-range clearance activities, if MEC is found, collected and treated, it is not considered a waste management activity. Any MEC found off-range is handled as potentially subject to RCRA.

Table 5-4 summarizes past locations and activities on ranges, ordnance testing facilities, and targets (Navy 1983a) that are not included in the IRP or RCRA Corrective Action Program. Ranges that are still operational are not included in Table 5-4. Instead, the operational ranges currently used are discussed in Section 5.3.2.2.

TABLE 5-3. SUMMARY OF IDENTIFIED PAST MUNITIONS BURIAL SITES

Site Name	Size (acre)	Range/Location	Status
Site 2 – Fenced Ordnance Burial Area	4.70	Missile Test Range	ROD/Remedial Action complete; LTM
Site 5 – Projectile Disposal Area	0.82	Terminal Range	Deferred Action
Site 9 – Disposal/Burn Area	7.91	West of Missile Test Range	ROD; LTM; Wetland monitoring
Site 17 – 1400 Area Landfill	7.58	North of Missile Test Range	ROD; LTM
Site 44 – Rocket Motor Pit	0.03	West of Missile Test Range	NFA
Site 47A – World War I Munitions Mound	0.63	Missile Test Range	EE/CA Removal Action complete
Site 57 – Shell House Dump	1.87	West of Missile Test Range	SSP complete
Site 61A – Gambo Creek Ash Dump	2.13	West of Missile Test Range	RI/FS complete; SSP complete
Site 61B – Gambo Creek Projectile Disposal	0.18	Terminal Range	Closed

Based on historical activities, the potential exists for residual MCs to remain on operational ranges and associated shorelines from historical operations identified in the 1972 map of potentially contaminated areas (Figure 5-3). Specific historical areas include:

- ***Missile Test Range***—This range, which includes the Old Plate Battery Test Area and IR Site 47B, could contain uncharacterized buried munitions per Figure 5-3. The shoreline in the vicinity of the Old Plate Battery Test Area has eroded some 120 feet in the past 45 years due to strong storms, including hurricanes. Based on MEC encountered during incidental trenching associated with nearby IR Site 47B and analysis of historical aerial photographs, the Old Plate Battery Test Area will continue to be checked for possible MEC until the shoreline is permanently stabilized.
- ***IR Site 1 (Old Bombing Range)***—This area is an 800-acre former bombing range that extends onto the Missile Test Range. The potential for UXO and DMM exists as a result of historical bombing operations. This area has been recommended for deferred action until the range is closed or property is transferred (see Appendix D).

- ***IR Site 2 (Fenced Ordnance Burial Area)***—A ROD has been signed, remedial action is complete, and this 4.7-acre site is undergoing LTM. Metals, explosives, and hydrocarbons have been detected during periodic groundwater monitoring conducted in wells surrounding the area at concentrations less than screening criteria.

TABLE 5-4. HISTORICAL RANGES, ORDNANCE TESTING FACILITIES, AND TARGETS

Range/Facility	Operations
Fragmentation Chamber (Building 428)	Projectiles and other devices containing up to 10 pounds of explosives were detonated in a pit of sawdust. All metal fragments were gathered, sorted, and weighed to produce data on fragment weight distribution.
Explosive Research Chamber (Building 1400)	Otherwise known as the Special Effects Test Facility or Special Effects Weapons Range, this facility was used to research shock wave physics. It had no provisions for explosives storage.
Missile Assembly Building (Building 994)	Used to assemble and disassemble ordnance. Also used as Remote Spin Firing Facility to test fuzes that were armed by spinning to simulate the effects of gun firing and checking for proper operation.
Conical Shock Tube (Building 1290)	Device also known as "DASCON" was used one time to simulate air blast effects of nuclear weapons through detonating conventional high explosives. It was otherwise used for projects requiring a long closed tube and for storage. It was dismantled and sold for scrap metal in October 1993.
Ordnance Radiography (Building 1180)	All nonmedical radiography tests performed here using X-ray generators up to 250 kV and cobalt-60 gamma ray sources up to 1,000 curies. Nondestructive examination of service and experimental ordnance and other related hardware, ranging from very small fuzes and cartridge-actuated devices to large bombs and rocket motors. Items are frequently examined after several environmental cycles. Portable X-ray generators and gamma projectors also are stored here.
Ballistic Recovery Tube Facility (Building 1181)	467-foot tube made of multiple 5-inch/38-caliber gun barrels used to produce low deceleration ("soft") recovery of 5-inch projectiles fired from a standard 5-inch/54-caliber Navy gun.
Environmental Test Chamber (Building 939)	Small-scale (1/8-pound explosives) tests of blast effects on inert material that had been subjected to heat and fire stress. It had no provisions for explosives storage.
Boxcar Firings	Gun projectiles (fuzed inert or explosive-loaded nonfuzed projectiles) fired into sawdust-filled boxcars from ranges of 100 to 4,000 feet. No explosives were detonated in boxcars. Testing conducted at Terminal Range for 100- to 600-foot tests and along railroad tracks parallel to Conical Shock Tube for tests up to 2,500 feet for naval guns and up to 4,000 feet for mobile guns (e.g., self-propelled howitzers).
Small-Caliber Terminal Range	Located on southeast tip of Terminal Range, used for penetration tests of small objects against light armor and for sensitivity tests (gun-firing explosives-loaded projectiles at various velocities against a steel target and assessing the reaction using high-speed motion pictures and overpressure measurements).
Main Range North	The Shipboard Magazine Evaluation Facility located here was used to develop techniques and systems to safely control inadvertent ignitions of missile propulsive units and of fires in missile magazines. There were also explosive vibration facilities, extreme range temperature facilities, salt-spray and rain test chambers, and a fire hazard control test facility (e.g., sprinkler systems). Tests using rockets, rocket-assisted targets, mortars, howitzers, and up to 5-inch naval guns were conducted at Main Range North.
Mk 68 Land-Based Test Site	A major portion of a shipboard fire control system was located here for testing and as a fire control system for a Mk 42 Mod 10 gun mount. Radar located here were the major electronic emitters closest to the Main Range gun line.
Explosives Research Facility (Building 370)	Firing range for certain kinds of research involving explosives up to 15 pounds. Includes a 600 kV X-ray system and flash X-ray coverage with framing cameras capable of taking 2.2 million frames per second that could be synchronized with the X-ray equipment.
Land Test Range	The 2,000-meter land range was located parallel to the Conical Shock Tube (Building 1290) and extended approximately 1,200 meters beyond the smaller end. It had a slightly raised gravel pad for placement of tanks and artillery pieces. The 1,000-meter range was usually used for graze testing using a 65- by 270-foot graze pad constructed of crushed stone and facilities for measuring accuracy and dispersion. Weapons up to 120-mm with inert or explosive loaded projectiles were fired on this range.
Targets	Armor plates, butts, and the river surface are the primary targets. Additional targets included: (1) tracking and calibration targets that cannot be fired at including aircraft (except for light planes brought from other locations), balloons, range patrol boats, diving tenders and other vessels, pilings in the river, land vehicles, and points of land; (2) targets that can be destroyed include floating radar reflectors, fixed platforms on the river, barges, small radio-controlled aircraft, boats, towed sleds, and causeway sections; and (3) target augmentation (e.g., electric and pyrotechnic infrared sources, bright lights, radar reflectors, electronic countermeasures, precision location systems, plywood, canvas, or fishnet "missed-distance indicators").

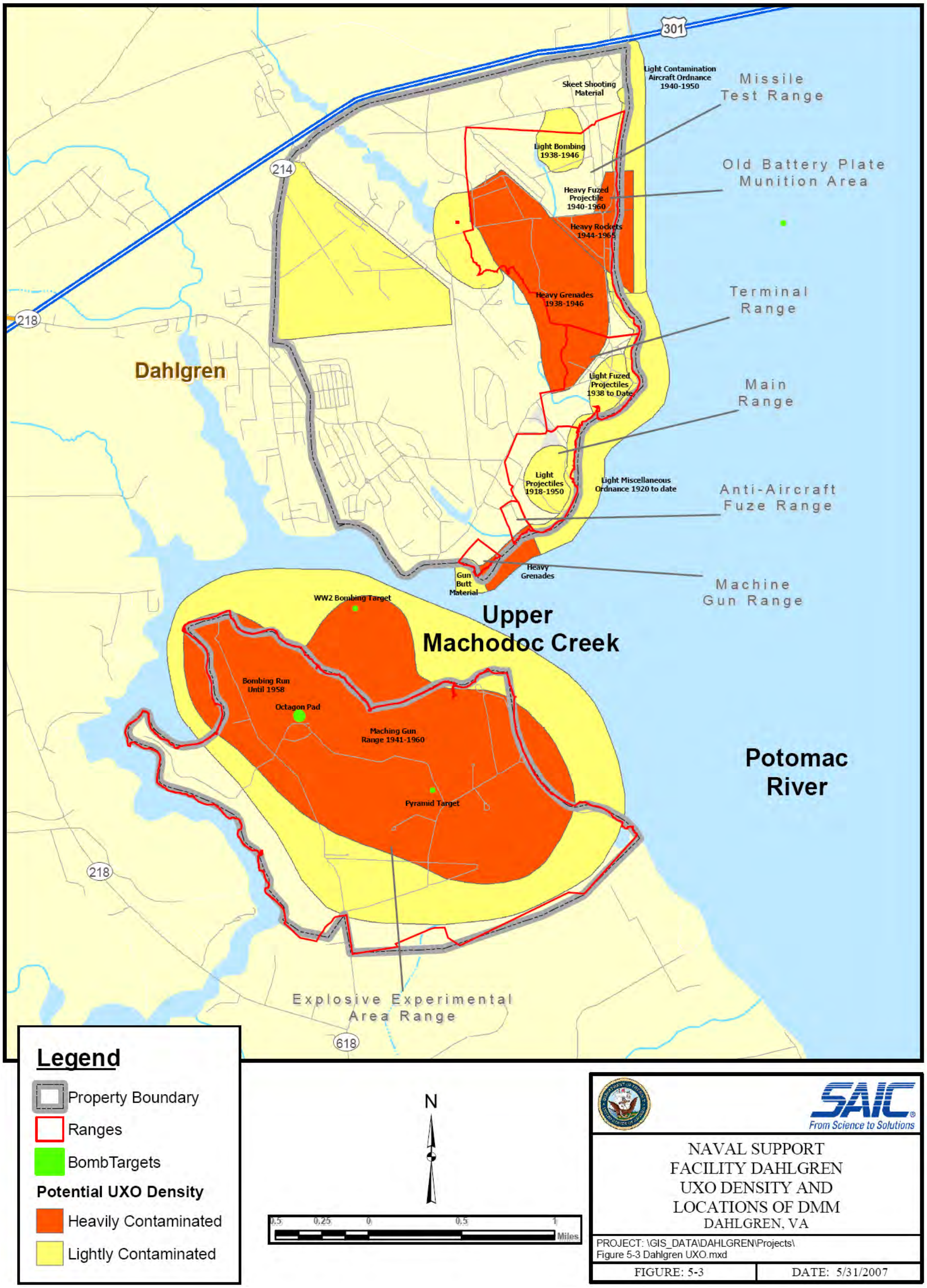


FIGURE 5-3. NAVAL SUPPORT FACILITY DAHLGREN UXO DENSITY AND LOCATIONS OF DMM

- ***IR Site 5 (Projectile Disposal Area)***—This suspected 0.82-acre site is located on the Terminal Range. It consists of past wetlands that may have been filled with rubble, projectiles, and MEC from a World War I munitions mound. This area has been recommended for deferred action until the range is closed or property is transferred (see Appendix D).
- ***IR Site 37 (Lead Contamination Area)***—This site is located on the Machine Gun Range. Semivolatile organic compounds (SVOCs) and metals have been detected in sediment. Explosives have not been detected in sediment samples, but USEPA suggests the potential presence of MEC at this site is high. A ROD amendment and remedial action was completed in 2007 (NSWC 2007).
- ***OB/OD Unit***—The OB/OD Unit located on the EEA Range includes current operations. The site is undergoing monitoring to comply with the RCRA permit requirements. HMX, perchlorate, and RDX have been detected in site shallow wells and are addressed in accordance with requirements specified in the RCRA permit. This area is currently being addressed in coordination with VDEQ.

5.3.2.2 Current Military Operations

Military RDT&E operations are currently conducted at the following land-based ranges: AA Fuze Range, Machine Gun Range, Main Range, Missile Test Range, Terminal Range, and EEA Range. Table 5-5 (Navy 2000 and NSWCDL 2007a) summarizes the operations currently conducted at these ranges and Table 5-6 (NSWCDL 2007a) shows numbers of munitions fired into PRTR and tests conducted at EEA. This section describes the sampling conducted for potential sources of MCs resulting from current and ongoing military operations.

The main activities that occur at NSWCDL-operated ranges include routine tests and experiments, including firing and fragmentation studies to evaluate the ballistics of projectiles and rockets as well as the safety and durability of materials such as armor plating. At NSWCDL-operated ranges, all new guns and relined guns, broadside and anti-aircraft mounts, and representative samples of most other ordnance material, including projectiles, armor, fuzes, and bombs, are subjected to proof and acceptance tests before being used for service.

Sampling was conducted in October 2006 (NAVFAC 2007a) on the middle and lower reaches of Gambo Creek, which lie in close proximity to Terminal Range, as part of the IRP. Samples GC 60 and GC 61 were collected closest to Terminal Range and were analyzed for metals and polynuclear aromatic hydrocarbons (PAHs). These samples were collected in a swampy area downgradient from the Terminal Range. The sampling results identified arsenic, chromium, copper, lead, and nickel in the unnamed tributary north of IR Site 62 (Building 396) above invertebrate effects concentrations (ECs) levels developed for the ecological assessment of Gambo Creek. No PAHs were detected. Concentrations of copper, lead, and nickel fell within Gambo Creek background ranges. The arsenic concentrations do not appear to correlate with levels detected in upper and lower reaches of Gambo Creek, nor does there appear to be a source of arsenic. Projectile firing at the Terminal Range was also ruled out for the following reasons:

- The metallurgy of projectiles and gun barrels suggest that concentrations of some metals, particularly copper and lead, should be found at higher concentrations, but were not. Arsenic is not associated with steel alloys in projectiles or gun barrels.
- PAHs are a common combustion byproduct, but were not detected.
- Arsenic was not detected in air emission studies conducted involving projectiles, while other metals such as copper and lead were detected at relatively high levels (USAEC 2006).

TABLE 5-5. CURRENT OPERATIONAL RANGES

Range	Operations/Potential Sources of MCs
Missile Test Range	***Operational Overview:*** This range is used to conduct overland test and evaluation of special weapon components against suspended targets. Experimental devices can be fired into the PRTR from this range. This range also encompasses an EOD training range for nonfragmenting energetic training operations. ***Potential Sources of MCs:*** Not all fired munitions include explosive charges. The potential sources of MCs on this range could include residues from live fuzes, explosive charges, propellants, and gun cleaning. IR Sites 1, 3, 10, 12, 43, 44, 47a, 47b, and 61a are found within Missile Test Range.
Terminal Range	***Operational Overview:*** Range supports RDT&E and production testing of weapon systems, components, and other ordnance material, including experimental items. This isolated range allows for ballistic evaluation of armor plates, penetration tests of projectiles, and high chamber pressure tests. A Projectile Recovery System is available to recover projectiles to study gun firing effects. Although most firings are aimed into butts or backstops, rounds can be fired into the PRTR. ***Potential Sources of MCs:*** Not all fired munitions include explosives charges. In fact, only 34 of 3,082 total rounds (approximately 1%) fired in calendar year 2006 contained high explosives. The potential sources of MCs on this range could include residues from live fuzes, explosive charges, propellants, and gun cleaning. IR Sites 5, 62, and AOC Z are found within Terminal Range.
Main Range	***Operational Overview:*** This range is used for systems integration and testing of shipboard combat system elements. The major caliber gun systems, located approximately 1,500 feet from the Potomac River, on this range use the PRTR as their over-the-water backstop. All acceptance testing of gun barrels and mounts are conducted at this range. ***Potential Sources of MCs:*** Not all fired munitions include explosives charges. In fact, only 820 of 2,438 total munitions (approximately 34%) fired into PRTR in calendar year 2006 contained high explosives. The potential sources of MCs on this range could include small amounts of residue from propellants. However, it should be noted that propellant residue would likely deposit on the asphalt area near the guns and runoff would likely collect in stormwater drains emptying onto base property then flowing over grass lands to Upper Machodoc Creek. Outfalls are analyzed for copper, total petroleum hydrocarbons, and biotoxicity. It is not likely that gun cleaning would be a concern at the Main Range because residues from historical operations were addressed under the IRP (Site 21 – Gun Barrel Decoppering Facility) and current operations take place in a closed container where residues are collected and transported offsite by a commercial disposal contractor (Navy 1983b). IR Sites 21, 22, 39, 53, and 60 are found within Main Range.
AA Fuze Range	***Operational Overview:*** This range is used for over-the-water testing of fuzes, proof tests, barrel wear and heating tests, projectile ramming tests, new projectile design evaluation, and water-surface burst data at short and long ranges. This range offers a large “safety zone” for fuze testing, since it is situated in close proximity to the Potomac River shoreline. The range includes temperature-conditioning equipment and propellant charge weighing and assembly equipment. ***Potential Sources of MCs:*** The potential sources of MCs on this range could include residues from live fuzes and explosive charges. Not all munitions expended at this range include explosive charges. In fact, only 298 of 749 total munitions (approximately 40%) fired in calendar year 2006 contained high explosives. IR Sites 23 and 48 and SWMUs 61, 62, 64, and 70 are found within AA Fuze Range.
Machine Gun Range	***Operational Overview:*** Range includes inside firing bays, indoor/outdoor firing bays, and an outdoor test area. It also includes bays that use the river range for penetration tests of light-armor materials. Testing 40-mm and smaller guns and ammunition is performed at this range as well as penetration testing of light armor materials. This range has temperature conditioning chambers and a charge assembly room. ***Potential Sources of MCs:*** A release of MCs from munitions fired indoors at this range is not likely. Projectiles fired into the PRTR are not recovered. The only potential source of MCs from this range is propellant residues associated with some of the outdoor firing bays. IR Sites 37 and 52 and SWMUs 125 and 130 are found within the Machine Gun Range.
EEA	***Operational Overview:*** This range is specially equipped to conduct environmental tests of explosive items – fast and slow cookoff tests, shock tests, and drop and vibration tests. Fragmentation arenas are set up to collect data on blast and fragmentation output of various kinds of explosive and ordnance items. The OB/OD facility is also located on this range. ***Potential Sources of MCs:*** Munitions residues are collected and analyzed upon completion of tests. In addition, residues are handled and disposed of in accordance with ORC Policy (Navy 2004b) requirements. As most activities with explosives are conducted at EEA, this area has the highest potential for MCs to remain. Potential releases of MCs would be detected in the area of the OB/OD units as the RCRA permits monitoring program requires the collection of soil samples on an annual basis and groundwater samples every 6 months. IR Sites 31, 32, 33, 36, 50 and 59 are found at EEA.

TABLE 5-6. SUMMARY OF MUNITIONS USAGE AND TEST EVENTS FOR 2006

Range	Total Rounds	HE Rounds	% HE Rounds
Main Range	2,438	820	33.6%
Terminal Range	3,082	34	1.1%
AA Fuze	749	298	39.7%
Shock Tube Road	28	0	0%
Total	6,297	1,152	18.3%
EEA Tests	**Number of Events**		
Arena	6		
Fast Cooks	7		
Slow Cooks	10		
Bullet Impacts	6		
Frag Impacts	18		
Sympathetic Dets	8		
Static Dets	22		
Shape Charge Jet Impact	2		
Total	79		

5.3.2.3 Future Military Operations

It is likely that current RDT&E operations will continue into the foreseeable future. The following bullets list additional operations that are likely to occur at NSWCDL-operated ranges (Navy 2004a):

- RDT&E of the extended range guided munition (ERGM), a projectile designed to have vastly improved accuracy
- Qualification testing of the 57-mm ammunition and gun system for the Coast Guard's new "Deep Water" Program, to be installed on their new class of ship
- Future range operations, including laser operations, EM testing, projectile testing, chemical and biological simulants, and radio frequency (RF).

Future military operations will be summarized in an EIS currently under development.

5.3.2.4 Overview of MCs

The following provides a discussion of MCs of potential concern. MCs are divided into categories as: (1) explosives, (2) propellants, or (3) pyrotechnics (U.S. Army 1984). Explosives and propellants generate large volumes of hot gases. The difference between explosives and propellants is the rate at which these gases are generated. Explosives produce faster reactions with shock waves capable of shattering objects. Propellants produce gas at relatively slower rates and generate lower pressures over longer periods. Pyrotechnics produce a great deal of heat, but less gas than explosives and propellants. The following sections describe additional characteristics and constituents associated with explosives, propellants, and pyrotechnics as related to RDT&E operations at NSWCDL-operated ranges.

Explosives

Military explosives are often discussed in terms of primary and secondary explosives. Primary explosives are very sensitive, but are characterized by less explosive power relative to secondary or HE. Primary explosives are easily detonated by heat, spark, impact, or friction. Munitions typically include much larger quantities of secondary explosives as compared to the amounts of primary explosives. Secondary explosives cannot be detonated by heat or shock. Instead, they are initiated by the detonation of primary explosives. They are also more powerful than primary explosives. As shown in Table 5-7, the constituents manufactured in primary and secondary explosives are distinctly different (U.S. Army 1984). The compositions listed in the right-hand column of Table 5-7 typically include different mixtures of aliphatic nitrate esters (e.g., pentaerythritol tetranitrate [PETN]), nitramines (e.g., HMX and RDX), and nitroaromatics (e.g., TNT). Other elements are often used in compositions such as tritanol, which includes a mixture of aluminum and TNT that is commonly used in Navy munitions.

TABLE 5-7. CONSTITUENTS IN PRIMARY AND SECONDARY EXPLOSIVES

Primary Explosives	Secondary Explosives	
• Diazodinitrophenol • Lead Azide • Lead Mononitroresorcinate • Lead Styphnate • Mercury Fulminate • Potassium Dinitrobenzofuroxane • Tetracene	***Aliphatic Nitrate Esters*** • 1,2,4-Butanetriol Trinitrate • Diethyleneglycol Dinitrate • Nitrocellulose • Nitroglycerin • Nitrostarch • Pentaerythritol Tetranitrate (PETN) • Triethylene Glycoldinitrate • 1,1,1 Trimethylolethane Trinitrate ***Nitramines*** • HMX • RDX • Ethylenediamine Dinitrate • Ethylenedinitramine (Haleite) • Nitroguanidine • Tetryl ***Nitroaromatics*** • Ammonium Picrate • 1,3-Diamino-2,4,6-Trinitrobenzene • 2,2'4,4',6,6'-Hexanitroazobenzene • Hexanitrostilbene • 1,3,5-Triamino-2,4,6-Trinitrobenzene • TNT	***Ammonium Nitrate Compositions*** • Binary Mixtures: Amatols, Composition A, Composition B, Composition C, Ednatols, LX-14, Octols, Pentolite, Picratol, Tetrytols, and Tritonal • Ternary Mixtures: Amatex 20; Ammonal; and High Blast Explosives (HBX) including HBX-1, HBX-3, and H-6; HMX, TNT, and aluminum mixture 3 (HTA-3); Minol-2; and Torpex • Quaternary Mixtures: Depth bomb explosives (DBX) • Plastic Bonded Explosives (PBX): PBXN-4, PBXN-5, PBXN-6, PBXN-201, PBX-0280, PBX-Type I, PBXC-116, and PBXAF-108 • Industrial Explosives: Dynamites, and ammonium nitrate fuel oil (ANFO) explosives

Temporary and permanent gun mounts are tested by firing projectiles into butts, armor plates, concrete blocks, or the PRTR. The butts are constructed using discarded armor plates (for testing projectiles) or experimental armor plates (for testing durability of armor material) secured to timbers. To recover projectiles, sand is often placed between the plates. Figure 5-4 illustrates the construction of an armor plate butt used for testing projectiles (Slover 1937). Thus, the materials comprising the armor plate target butts are not likely to be a concern for RSEPA.

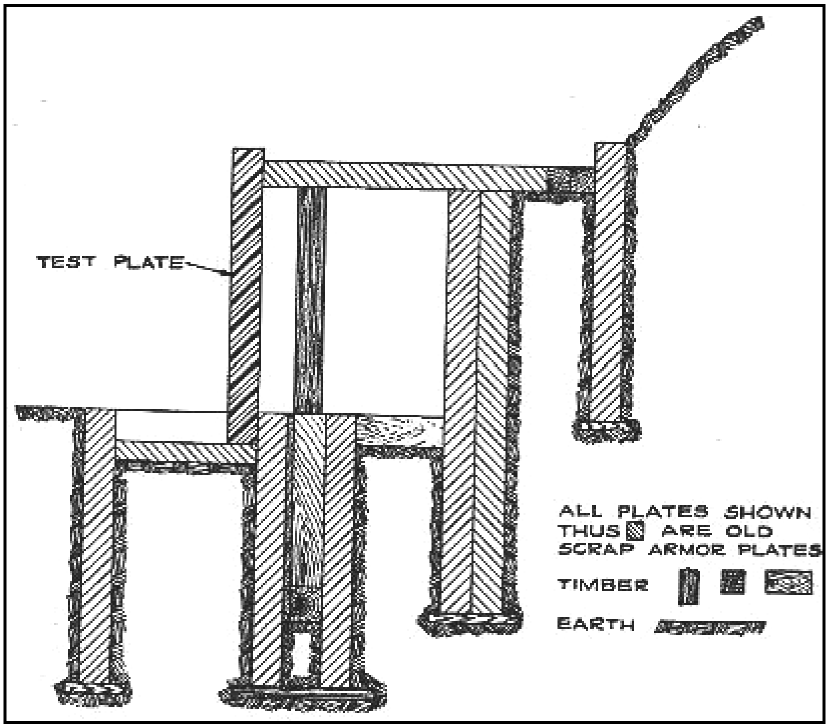


FIGURE 5-4. CROSS-SECTION OF AN ARMOR PLATE BUTT

Projectiles are classified by Slover (1937) as armor-piercing (thicker-walled with 2.1 to 2.6 percent of the total weight of the projectile being HE), common (thinner-walled with 3 to 6 percent of the total weight of the projectile being HE), high-capacity (thinnest-walled with 10 to 25 percent of the total weight of the projectile being HE), target (economical substitute for armor-piercing rounds used in target practice and proving ground work), proof shot (sometimes called "slugs," are a solid cast-iron shot with a square forward end), and line carrying (designed to carry a line for use in rescue work). For armor testing, residual munitions components typically are removed to the extent needed to maintain safe work areas. In some cases, fuzes and other munitions components are left in place until the armor plate butt is replaced, repaired, or retrofitted. Historically, residual material removed from plate butts has been transported elsewhere on NSDF. These sites have been or are being addressed in the IRP or MRP. In cases where the goal of the test is to understand fragmentation patterns, most residues are collected, studied, and disposed of in accordance with the Navy's ORC policy (Navy 2004b) requirements.

Explosive and nonexplosive projectiles also are fired into the PRTR to test ballistics and propellants (discussed below). Advances in technology and computer simulation have resulted in a decrease in the number of projectiles fired into the river from approximately 25,000 in the 1960s to approximately 5,000 in 2006 (NSWCDL 2007a). Projectiles fired into the river are mostly filled with inert material (concrete) or are designed to detonate prior to impact with the water. For the few rounds that do not detonate prior to impact (estimated at approximately 3 percent according to Dauphin and Doyle 2000), they sink into the sediments underlying the Potomac River and remain buried, or they become a solid base like a small reef where organisms such as oysters, invertebrates, and algae colonize (NSWC 2005a). Other projectiles include sophisticated sensors and test equipment that could include hazardous items (e.g., batteries), but these projectiles hold valuable information needed to complete the test, so they are recovered when possible.

A study sponsored by the Strategic Environmental Research and Development Program (SERDP) evaluated the corrosion of UXO and concluded that the corrosion rates resulting from perforation of

½-inch casings ranged from 320 to 4,200 years (Packer 2002 and 2004). Due to the reducing (as opposed to oxidizing) conditions typically found in deeper sediments, the environmental conditions needed for corrosion to occur are far less likely and probably mean that corrosion takes even longer if at all.

For the minimal number of munitions that do not detonate and eventually corrode, the explosive material that could be released to the environment ranges from 0.011 pounds (0.005 kg) for 20-mm projectiles to 30 pounds (13 kg) for 8-inch projectiles. Table 5-8 lists ranges of explosive charges for various caliber projectiles fired from NSWCDL-operated ranges. Since 16-inch projectiles are no longer fired, results are shown for illustrative purposes.

TABLE 5-8. MASSES OF EXPLOSIVES IN VARIOUS CALIBER PROJECTILES

Weapon System	Explosive Charge*
16-inch	From 0.15 pounds (0.068 kg) (spotting charge) to 154 pounds (70 kg)
8-inch	From 0.38 pounds (0.17 kg) to 30 pounds (13 kg)
155 mm	From 0.42 pounds (0.19 kg) to 26 pounds (12 kg)
5-inch	From 0.022 pounds (0.0099 kg) to 11.2 pounds (5.1 kg)
20 mm	From 0.011 pounds (0.005 kg) to 0.097 pounds (0.044 kg)

* http://www.maic.jmu.edu/ordata/. Note that ranges are provided for rounds containing explosive charges.

Propellants

Akhavan (2004) defines propellants as, "…explosive material which undergoes rapid and predictable combustion (without detonation) resulting in a large volume of hot gas…to propel a projectile, i.e. a bullet or a missile…" Gun propellants are considered homogeneous (i.e., the chemical molecule includes the oxygen source) and rocket propellants are considered heterogeneous (i.e., fuel and oxidizers are found in separate chemicals) (Akhavan 2004).

The basic ingredients in propellants have remained the same over the past 30 years (NRC 2004). No propellants using new materials have been fielded, but the processing, formulation, and manufacturing using nitrocellulose, nitroguanidine, nitroglycerin, and other nitrate esters has improved (NRC 2004).

Gun propellants are classified as single-base, double-base, triple-base, and composite. Single-base compositions are used in cannons, small arms, and grenades. Nitrocellulose is the main ingredient and includes stabilizers, inorganic nitrates, nitrocompounds, and nonexplosive materials, such as metallic salts, metals, carbohydrates, and dyes. Double-base compositions are used in cannons, small-arms, mortars, rockets, and jet propulsion units. Double-base propellants include nitrocellulose and nitroglycerin as the main ingredients and include other ingredients such as plasticizers and stabilizers. Triple-base propellants are used in cannon units and include nitrocellulose, nitroglycerin, and nitroguanidine as the main ingredients. Single-, double-, and triple-base propellants include plasticizers and stabilizers. Composites are used primarily in rocket assemblies and jet propulsion units. Composites generally consist of physical mixtures of fuels (e.g., metallic aluminum), binders (generally a synthetic rubber that is also a fuel), and an inorganic oxidizing agent such as ammonium perchlorate (U.S. Army 1984). Table 5-9 lists examples of additives used in gun propellants (Akhavan 2004).

Rocket propellants are very similar to gun propellants, but gun propellants burn more rapidly due to the desired higher pressures in the gun barrels. Rocket propellants are designed to burn at approximately 7 megaPascals (MPa) as opposed to approximately 400 MPa for gun propellants. Rocket propellants also must burn for a longer period of time to carry the rocket with the sustained impulse (Akhavan 2004).

TABLE 5-9. ADDITIVES USED IN GUN PROPELLANTS

Function	Additive	Action
Stabilizer	Carbamite (diphenyl diethyl urea), methyl centralite (diphenyl dimethyl urea), chalk, and diphenylamine	Increase shelf life of propellant
Plasticizer	Dibutyl phthalate, carbamite, and methyl centralite	Gelation of nitrocellulose
Coolant	Dibutyl phthalate, carbamite, methyl centralite, and dinitrotoluene	Reduce flame temperature
Surface moderant	Dibutyl phthalate, carbamite, methyl centralite, and dinitrotoluene	Reduce burning rate of grain surface
Surface lubricant	Graphite	Improved flow characteristics
Flash inhibitor	Potassium sulfate, potassium nitrate, potassium aluminum fluoride, and sodium cryolite	Reduce muzzle flash
Decoppering agent	Lead or tin foil, compounds containing lead or tin	Remove copper deposits left by driving band
Anti-wear	Titanium dioxide and talc	Reduce erosion of gun barrel

Rocket propellants include double-base and composite types. Like gun propellant, it is manufactured with nitrocellulose and nitroglycerin, but the grain sizes are larger and fewer in number. Composite propellants are two-phase physical mixtures including a crystalline oxidizer (ammonium perchlorate) in a polymeric fuel/binder mixture (Akhavan 2004).

The large guns used at the Mainside ranges employ propellant charges packed in Rayon bags. The total number of bags is modified according to the weight and desired velocity of the projectile that is manufactured and issued separately from the propellant. Table 5-10 includes the typical charges (amount) of propellants needed for different caliber guns/ammunition.

TABLE 5-10. GUN PROPELLANTS CHARGES

Weapon System	Propellant Charge
16-inch/50-caliber Marks 2 and 3	Ships: 700 pounds (318 kg)[b] Coastal Defense Batteries: 672 pounds (305 kg) and 648 pounds (294 kg)[b]
8-inch	83 pounds (37.65 kg)[c]
155-mm (6.1 inches) Howitzer	6.17 pounds (2.8 kg), single-based propellant (green bag M3A1)[a]
5-inch	24.5 pounds (11.1 kg)[b]
20 mm/70-caliber Marks 2, 3, and 4	0.061 pounds (0.0277 kg)[b]

[a] Walsh et al. 2005
[b] http://www.usstexasbb35.com/
[c] http://www.navweaps.com/Weapons/WNUS_8-55_mk71.htm

Walsh et al. (2005) evaluated residues at 155-mm Howitzer firing points and impact areas at the Donnelly Training Area, Alaska, in January 2005. They collected samples from ice and snow, which allowed them to sample the residues on an explosives-free surface and to visually demarcate the extents of the residual plumes. They collected multi-increment samples from a 40- by 4-meter area parallel to the line of fire, a 30- by 4-meter area perpendicular to the gun's muzzle, and a 30- by 30-meter area in front of the gun muzzle. Tables 5-11 and 5-12 summarize the results from Walsh et al. (2005).

TABLE 5-11. FIRING POINT RESIDUES FROM 155-mm HOWITZERS

Sample	Rounds Fired	Sample Location	2,4-DNT In Snow Melt (µg)	2,4-DNT in Soot (µg)	Estimated Total Mass Deposited (µg)
1	30	Parallel to gun	8.7	5.1	2,400
2	30	Parallel to gun	8.1	8.8	3,000
3	30	Parallel to gun	29	12	7,800
1	30	Perpendicular to gun	72	35	13,000
2	30	Perpendicular to gun	13	35	5,700
3	30	Perpendicular to gun	20	9	3,500
1	60	30- by 30-meter area	100	28	110,000
2	60	30- by 30-meter area	14	6.4	19,000
3	60	30- by 30-meter area	62	34	86,000

0.3-m^2 aluminum trays were placed at 5-m intervals out to 40 m along the line of fire and five trays were placed at 3m intervals out to 15 m perpendicular to the line of fire on either side of the muzzle

TABLE 5-12. WEIGHT OF MATERIAL DEPOSITED ON ALUMINUM TRAYS

Distance In Front of Gun (m)	Mass (mg)	Distance to Right of Gun (m)	Mass (mg)	Distance to Left of Gun (m)	Mass (mg)
5 m	835	3 m	609	3 m to left of gun	77
10 m	1,311	6 m	493	6 m	66
15 m	223	9 m	467	9 m	18
20 m	[a]	12 m	367	12 m	10
25 m	[a]	15 m	199	15 m	4
30 m	1.1	[b]	[b]	[b]	[b]
35 m	[a]	[b]	[b]	[b]	[b]
40 m	[a]	[b]	[b]	[b]	[b]

[a] Not detected
[b] Not measured

The sample results listed in Tables 5-11 and 5-12 were collected after firing 30 or 60 rounds of 155-mm projectiles.

In addition to the constituents in propellants described above, there are other potential sources of MCs to consider in evaluating the firing of projectiles. A small amount of lead foil is included in propelling charges to clear the bore of the metal fouling that scrapes off projectile rotating bands onto the rifling as the projectile passes through the barrel. In addition, the constituents that comprise the gun barrels, projectiles, and rotating bands should be considered. Steel alloys used to manufacture projectiles and gun barrels include different proportions of iron, carbon, manganese, phosphorus, sulfur, silicon, copper, lead, boron, chromium, nickel, molybdenum, aluminum, zirconium, niobium, titanium, and vanadium (Metallurgical Consultants 2007). In addition, pure copper, copper alloys (e.g., copper/zinc alloys in minor- and medium-caliber projectiles, copper/nickel alloys in major-caliber projectiles), or plastic are used as the material for rotating bands. The bourrelet is a part of a projectile that stabilizes it while traveling through the gun bore and the rotating band seals the propellant gases, imparts rotation, and acts as a rear stabilizer for projectiles. Thus, friction between the gun barrels, bourrelets, and rotating bands could produce metal particles that would exit the muzzle of the gun when fired.

Considering that large- and small-caliber munitions have been fired for almost 90 years, the possibility exists that propellant residues and metallic residues from barrels and projectiles could remain in soil near the firing points at NSWCDL-operated ranges. The permanent gun mounts range from 194 to 1,562 feet with an average of 960 feet from the Potomac River. Based on the topography and proximity to the Potomac River, it is reasonable to assume that most of the propellant and metal residues reached the PRTR immediately after firing or infiltrated into soil and possibly then into groundwater followed by later migration into the PRTR. Regardless of the magnitude and timeframes involved, these constituents either remain on or under one of the Mainside Ranges or have migrated into the PRTR where detection is unlikely. Burning of propellants at the EEA OB unit has been characterized through sampling and continues to be monitored to meet the requirements of the RCRA OB/OD permit.

Pyrotechnics

Military pyrotechnics are used to produce heat, colored smoke, and bright-colored lights (Akhavan 2004). The primary ingredients include oxidizers and fuel and include additional ingredients such as binding agents, retardants, and waterproofing agents. Two oxidizing agents, based on oxygen and fluorine, are currently used in pyrotechnic compositions. Oxygen-based oxidizers are typically manufactured in forms of nitrates of barium, strontium, sodium, and potassium; perchlorates of ammonium and potassium; or peroxides of barium, strontium, and lead. Fluorine as an oxidizer is usually manufactured in the forms of polytetrafluoroethylene or chlorotrifluoroethylene (U.S. Army 1984).

Pyrotechnics are used within munitions in primers and delays. Pyrotechnics also are used in smoke and light-emitting rounds. Examples of various ingredients of pyrotechnics are listed in Table 5-13 (Akhavan 2004).

TABLE 5-13. PRIMARY INGREDIENTS IN PRIMERS, DELAYS, SMOKE, AND LIGHT EMITTERS

Primers	Delays
Percussion Primers • Potassium chlorate • Lead peroxide • Antimony sulfide • TNT **Stab Primers** • Potassium perchlorate • Lead thiocyanate • Antimony sulfide	• Black powder • Tetranitrocarbazole and potassium nitrate • Boron, silicon, and potassium dichromate • Tungsten, barium chromate, and potassium perchlorate • Lead chromate, barium chromate, and manganese • Chromium, barium chromate, and potassium perchlorate
Smoke	**Light Emitters**
• White: Zinc dust, hexachloroethane, and aluminum • White: Phosphorus pentoxide and phosphoric acid • Black: Sulfur potassium nitrate, and pitch • Black: Potassium chlorate, naphthalene, and charcoal • Grey: Zinc dust, hexachloroethane, and naphthalene • Grey: Silicon tetrachloride and ammonia vapor • Yellow; Auramine, potassium chlorate, baking soda, and sulfur • Yellow: Auramine, lactose, potassium chlorate, and chrysoidine • Red: Rhodamine red, potassium chlorate, and antimony sulfide • Red: Rhodamine red, potassium chlorate, baking soda, and sulfur • Green: Auramine, indigo, potassium chlorate, and lactose • Green: Malachite green, potassium chlorate, and antimony sulfide • Blue: Indigo, potassium chlorate, and lactose • Blue: Methylene blue, potassium chlorate, and antimony sulfide	• White: Magnesium, barium nitrate, and potassium nitrate • Green: Potassium perchlorate, barium nitrate, and binder • Red: Potassium perchlorate, strontium oxalate, and binder • Yellow: Potassium perchlorate, sodium oxalate, and binder • Blue: Potassium perchlorate, copper carbonate, and polyvinyl chloride • Red Tracer: Magnesium, strontium nitrate, and binder

5.3.3 *Environmental Component*

The following sections present an evaluation of the environmental components of the ORSM for the Mainside Ranges and EEA Ranges. To ensure the long-term sustainability of NSWCDL-operated ranges for RDT&E, the Navy must define existing environmental conditions at the ranges and plan for their continued best management. Information was collected for the Mainside Ranges and EEA Ranges regarding predominant soil types; topography; vegetation; surface water and groundwater aquifer characteristics; potential or known sensitive receptors and ecosystems; cultural resources; and historical military operations that are known to or potentially have affected the environment.

5.3.3.1 Predominant Soil Types

There are 14 soil types found on NSFD, as shown in Figure 5-5. The Tetotum-Bladen-Bertie soil association is found at NSFD and the surrounding area. This association consists of deep, moderately well-drained or poorly drained soils having clay loam, sandy clay loam, or clay subsoil, and occurring in broad, low-lying areas (NSFD/NAVFAC 2007b).

Three different hydric soil series according to the State of Virginia Hydric Soil Series List are found at NSFD and include Bladen loam, Fallingston very fine sandy loam, and Pooler loam. These soils typically support hydrophytic vegetation and occur in wetland areas. Large sections of the Mainside and EEA Ranges contain Bladen loam. This soil is characterized by a clayey texture and is common where a seasonally high water table remains near the surface for long periods. Fallingston very fine sandy loam is also located throughout the Mainside and EEA Ranges and is common where the high water table is at the surface or within a depth of 1.5 feet during wet periods. Pooler loam only occurs within the western portion of the EEA Range and is characterized by textures from heavy clay loam to very fine sandy loam. The seasonal high water table associated with Pooler loam is usually at a depth of 1 to 1.5 feet in winter and spring (NSFD/NAVFAC 2007b).

5.3.3.2 Predominant Topography

NSFD is located in the Coastal Plain physiographic province, which consists of relatively unconsolidated and undeformed sediments ranging in thickness from a few hundred feet along the inner margin to greater than 2,500 feet in areas along the Atlantic Ocean. The Coastal Plain province in Virginia is characterized by low relief, with elevations ranging from sea level to 400 feet above mean sea level (msl). Most of the slopes at NSFD are gradual and the elevation ranges from 0 to approximately 24 feet above msl. Some steeper slopes are located along sections of installation watercourses and shorelines. The Nanjemoy Formation of the Coastal Plain province underlies NSFD and is composed of alternating quartz and glauconite sands, clays, and calcitic units of shell and cavernous shell limestone (NSFD/NAVFAC 2007b). Figures 5-6 and 5-7 show the surface elevation contours and stormwater runoff directions for Mainside and EEA areas, respectively.

5.3.3.3 Predominant Vegetation

There are more than 300 plant species representing 86 families at NSFD (NSFD/NAVFAC 2007b). The following paragraphs discuss the predominant vegetation found at the Mainside Ranges and EEA Ranges.

A comprehensive ecological community survey has not been conducted at NSFD, but various natural resources mapping and surveying efforts provide an overall understanding of the existing communities. Overall, the terrestrial system (uplands) accounts for 84 percent of NSFD while the remaining estuarine and palustrine systems (wetlands) account for the remaining 16 percent. Approximately 51 percent of the installation is forested with 28 percent oak-hickory, 15 percent loblolly pine, and 8 percent loblolly pine-hardwood. Open uplands comprise 33 percent of the installation and include grasslands (6 percent) and developed/maintained areas (27 percent). The wetlands portion of the NSFD is divided into 10 percent tidal or estuarine and 6 percent nontidal, freshwater wetlands (i.e., palustrine) (NSFD/NAVFAC 2007b).

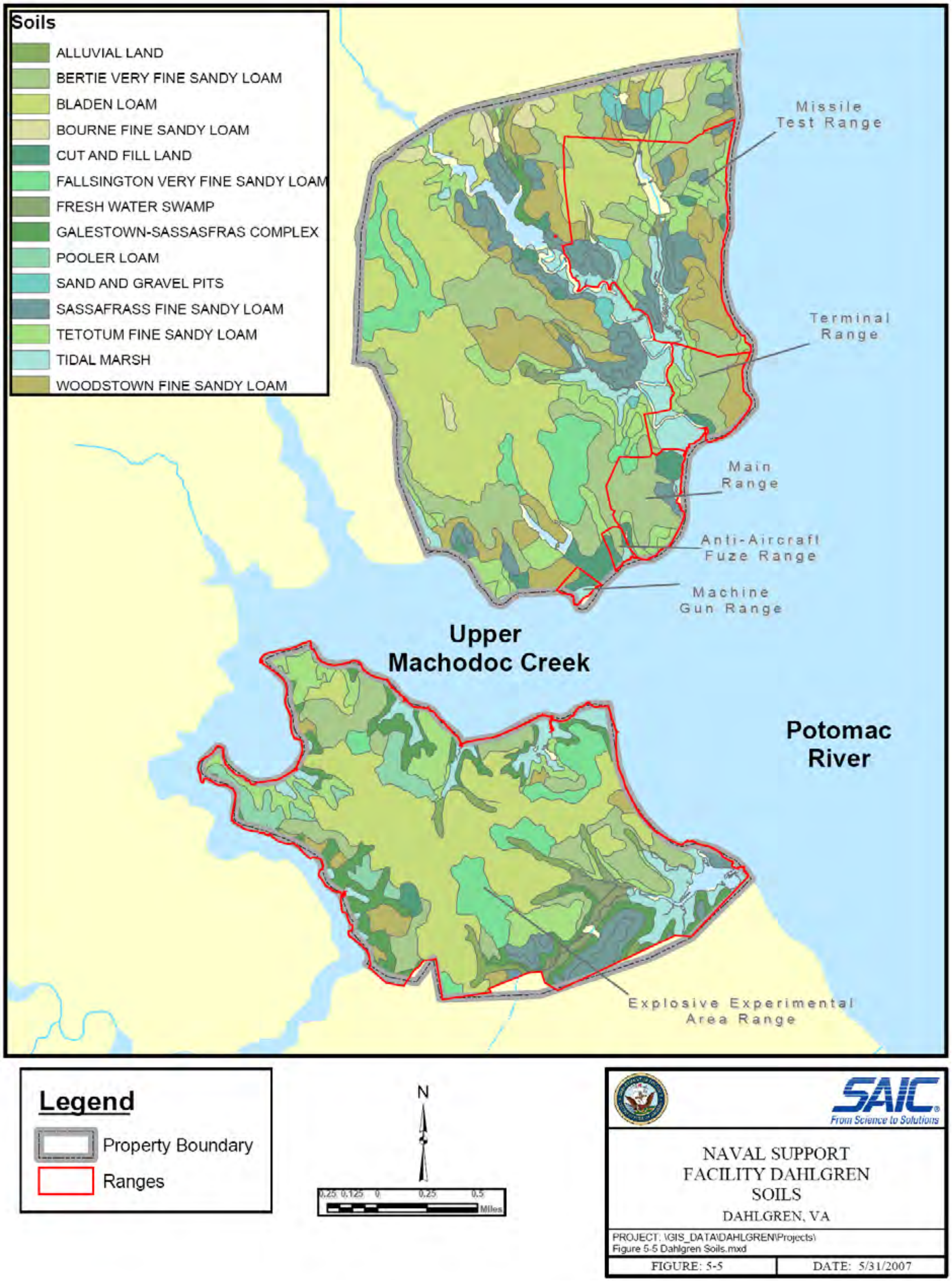


FIGURE 5-5. NAVAL SUPPORT FACILITY DAHLGREN SOILS

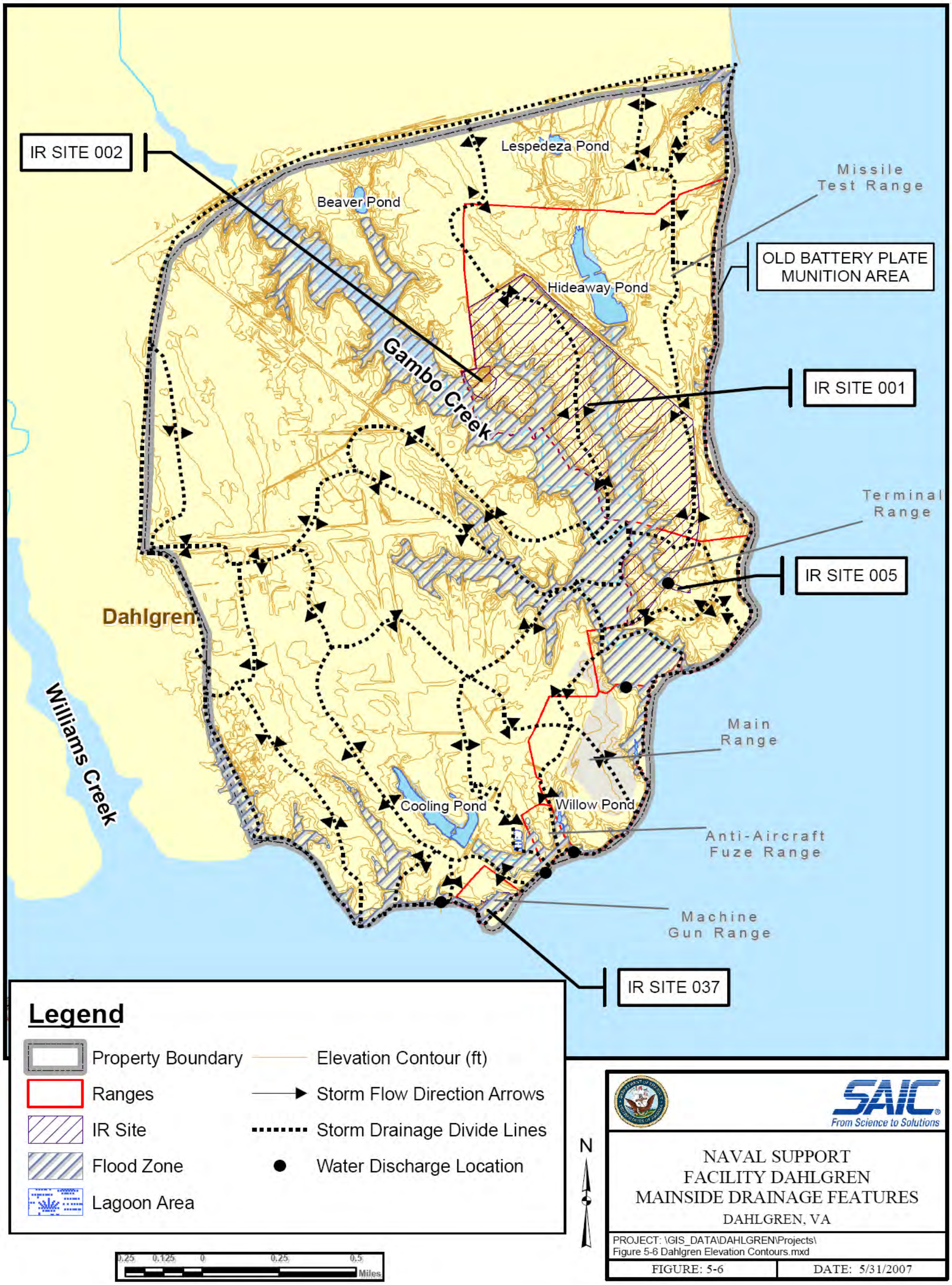


FIGURE 5-6. NAVAL SUPPORT FACILITY DAHLGREN MAINSIDE DRAINAGE FEATURES

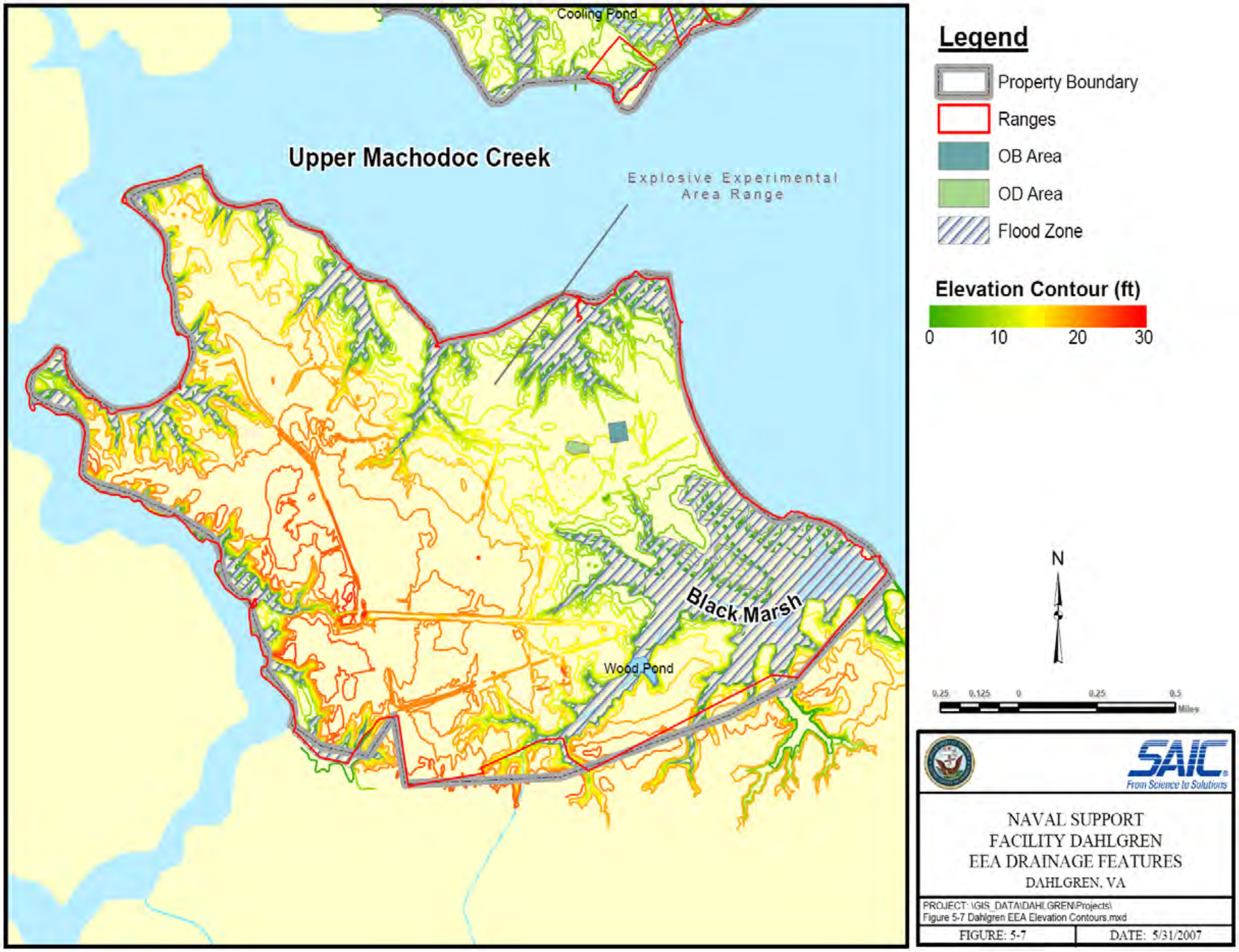


FIGURE 5-7. NAVAL SUPPORT FACILITY DAHLGREN EEA DRAINAGE FEATURES

The two major ecological communities on the Mainside are grassland and developed/maintained areas and pine and hardwood forest. Hardwood forest, pine forest, wetlands, and surface water are also present, but to a lesser degree. Pine and hardwood forest is the major ecological community on the EEA Range with developed/maintained areas, hardwood forest, wetlands, pine forest, and surface water also present, but to a lesser degree.

5.3.3.4 Surface Water and Groundwater

The following five principal surface water bodies are associated with NSFD: Potomac River, Upper Machodoc Creek, Gambo Creek, Hideaway Pond, and Cooling Pond. NSFD has approximately 4 miles of Potomac River shoreline. The width of the river adjacent to the installation is approximately 9,000 feet. The Potomac River watershed encompasses approximately 14,670 square miles. The river adjacent to NSFD is tidal and classified as an estuary zone. The salinity regime is mesohaline (5 to 12 parts per thousand [ppt]) and varies depending on rainfall. The State of Maryland has jurisdiction over the Potomac River and has designated the river as Class II (waters suitable for shellfish harvesting) under the Maryland Water Pollution Control Regulations. Water quality near NSFD meets the Federal CWA's standards for water-contact recreation, aquatic life, and shellfish harvest (NSFD/NAVFAC 2007b).

NSFD has approximately 6 miles of Upper Machodoc Creek shoreline. Upper Machodoc Creek is approximately 3,000 feet wide at the mouth and 6 feet deep with a watershed encompassing 47.2 square miles. The creek and its tidal tributaries are designated Class IIa (estuarine waters capable of propagating shellfish), while the remaining tidal tributaries to the Potomac River within the installation are designated Class IIb water (estuarine water with Potomac embayment standards) by Virginia Water Quality Standards (Virginia Regulation [VR] 680-21-00; NSFD/NAVFAC 2007b).

As illustrated in Figure 5-6, Gambo Creek divides the Mainside Ranges into two tracts. This creek is tidally influenced as far as the northern boundary of the installation. Hideaway Pond and Cooling Pond are two man-made freshwater impoundments (NSFD/NAVFAC 2007b).

No drainage from NSFD enters surrounding lands, but is all directed to either the Potomac River or Upper Machodoc Creek. All drainage from NSFD is part of the Chesapeake Bay estuarine system (NSFD/NAVFAC 2007b).

The hydrogeology and inorganic water quality in the aquifers underlying Mainside at NSFD was investigated by the U.S. Geological Survey (USGS) (USGS 1994 and 1996) to provide the Navy with site-specific data needed for preparation of a spill contingency plan. The investigation was initiated in 1992 and consisted of:

- Installation of 35 observation wells, including 3 clustered locations
- Lithologic and geophysical (natural gamma, spontaneous potential, single point resistance, normal resistivity) logging
- Slug testing at 27 locations
- Laboratory testing for vertical hydraulic conductivity
- Synoptic water level measurements
- Hourly water level monitoring at 11 locations
- Tide monitoring on Upper Machodoc Creek
- Groundwater sampling at 35 wells, and
- Surface water sampling at three locations along Gambo Creek.

The USGS investigations identified five hydrogeologic units consisting sequentially of the Columbia aquifer, an upper confining unit, an upper confined aquifer, the Nanjemoy-Marlboro confining unit, and the Aquia aquifer occurring within the upper 220 feet of sediment underlying the installation.

The uppermost Columbia aquifer is unconfined with groundwater recharge at topographic highs on the northern Mainside and groundwater discharge occurring along low-lying areas associated with the Gambo Creek drainage. The aquifer consists of variably distributed clay, silt, sand, and gravel with a median hydraulic conductivity of 1.76×10^{-4} centimeters per second (cm/sec). The groundwater flow direction across Mainside is largely redirected toward the Gambo Creek drainage in the center of the installation and through the Missile Test Range and Terminal Range ultimately discharging to the Potomac River or Upper Machodoc Creek. Under natural flow conditions, most groundwater in the Columbia aquifer discharges to adjacent surface water bodies (USGS 1996).

Groundwater in the Columbia aquifer is acidic with a median pH of 5.3 standard units and a highly variable inorganic chemical composition. The observed variability reflects both natural and anthropogenic sources of chemical constituents (USGS 1996). As such, the aquifer does not comprise a viable potable water source. The Columbia aquifer is segregated from the underlying Upper Confined and Aquia aquifers by the Upper Confining Unit, which occurs continuously beneath Mainside.

5.3.3.5 Sensitive Receptors and Ecosystems

The following sections discuss the sensitive receptors and ecosystems found within the Mainside Ranges and EEA Ranges. These sections also address human impacts to sensitive ecosystems at these ranges.

Mainside and EEA Ranges Known Threatened and Endangered Species

A Natural Heritage Inventory was conducted at Dahlgren during 1991 and 1992 by the Virginia Department of Conservation and Recreation, Division of Natural Heritage (VDCR-DNH). The goal of the inventory was to identify rare plants and animals, special interest areas (Figure 5-8), and other significant natural features. NSFD also conducted a Rare, Threatened, and Endangered Plant Species Survey in December 2004. The purpose of this survey was to identify any state listed and federally listed rare, threatened, and endangered plant species that may occur on NSFD. Due to the recent delisting of the bald eagle (*Haliaeetus leucocephalus*), there are no threatened or endangered species identified at NSFD. USFWS, in cooperation with the states, must monitor the status of species that have recovered and been delisted for at least 5 years. Thus, Dahlgren may be asked to cooperate in the post-delisting monitoring plan as discussed in the FR (Vol. 72, no. 130: 37373. July 7, 2007). Bald eagles have successfully nested at various locations on the installation since at least 1991. Active nest sites have been observed on the Mainside and EEA Ranges (NSFD/NAVFAC 2007a). Annual bald eagle nesting surveys are conducted by the College of William and Mary in cooperation with the VDGIF. These activities should allow Dahlgren to provide data to USFWS if asked to cooperate in the post-delisting monitoring plan. Bald eagle protection zones are established during the nesting season in accordance with the Bald Eagle Protection Guidelines for Virginia (NSFD/NAVFAC 2007a). The specific impacts to NSWCDL outdoor testing from the recent delisting of the bald eagle are delineated in the “Assessment of Vulnerabilities of Bald Eagles to Outdoor Testing at NSFD” (NSFD 2007). This could become an issue for NSWCDL RDT&E mission if nesting sites increase on NSFD.

There are five Special Interest Areas (SIAs) at NSFD, which represent areas with unique ecological characteristics and/or high-quality habitat for rare species. Three of these SIAs were established based on the inventory conducted in 1991 and 1992. The original boundaries were updated and new SIAs were established in 2001 based on new information and changing conditions (e.g., new bald eagle nesting sites). Two SIAs totaling 810 acres occur on the Mainside Ranges and three SIAs totaling 223 acres occur on the EEA Range. The SIAs (Forested Wetland Swale, Gambo Creek, Tetotum Flats North, Tetotum Flats South, and Tetotum Flats East) are discussed below:

- The Forested Wetland Swale is 167 acres in the northwestern portion of Mainside that provides rare invertebrate habitat. The swales drain toward the north end of the airfield and the northern border of swales are adjacent to County Route 614. Rare invertebrates are no longer documented in this SIA.

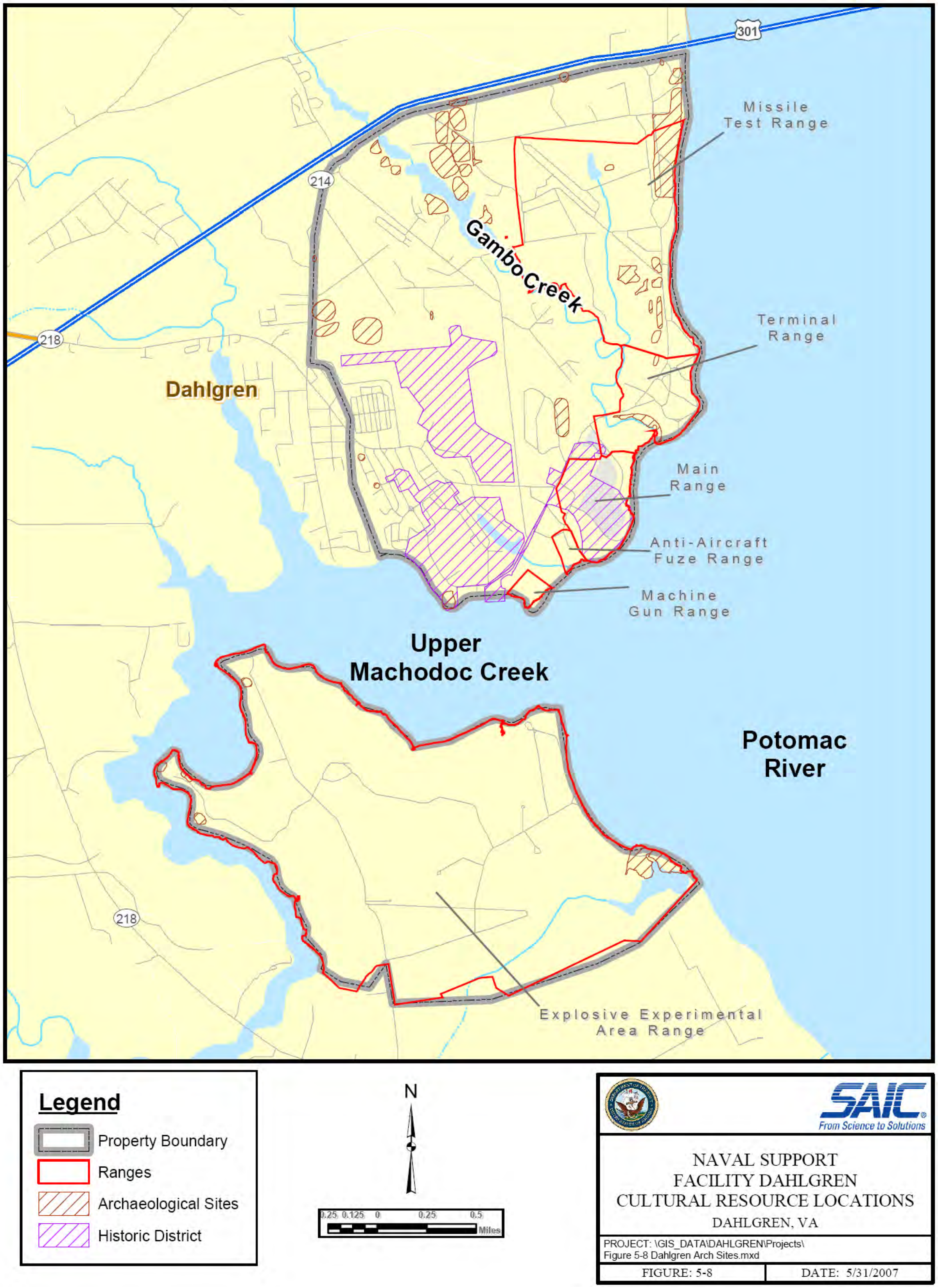


FIGURE 5-8. NAVAL SUPPORT FACILITY DAHLGREN CULTURAL RESOURCE LOCATIONS

Gambo Creek is 643 acres of extensive brackish-intertidal marsh on Mainside providing bald eagle nesting habitat; foraging habitat for eagles, ospreys, and other birds; nursery habitat for fish; and habitat for uncommon invertebrates. This SIA is well-buffered by mixed hardwood and pine forests. Bald eagles nested in this SIA during the 2000-01 nesting season.

- Tetotum Flats North is 124 acres of undeveloped forested area adjacent to Upper Machodoc Creek and Wood Island in the northwestern portion of the EEA Range that provides bald eagle nesting habitat. Bald eagles have successfully nested in this area since at least 1991.
- Tetotum Flats South is 44 acres of undeveloped forested area located adjacent to Upper Machodoc Creek in the southwestern corner of the EEA Range that provides bald eagle nesting habitat. An active bald eagle nest was located in this area for the first time during the 2000-01 nesting season.
- Tetotum Flats East is 55 acres of undeveloped forested area in the interior of the EEA Range that provides bald eagle nesting habitat. At the time of the INRMP, an active bald eagle nest had been located at this SIA for at least 4 years (NSFD/NAVFAC 2007a).

Human Impacts on Sensitive Ecosystems on Mainside and EEA Ranges

The five SIAs discussed in the previous section could be considered sensitive ecosystems. Human impacts to these SIAs range from potentially minimal to potentially extensive. The three SIAs on the EEA Range have received fewer human impacts than those on Mainside because there is less development on EEA compared to Mainside, there are fewer IR sites on EEA compared to Mainside, and the EEA SIAs are much smaller than the Mainside SIAs. The OB/OD units, which have been mentioned previously as an area with potential for residual MCs, are not close to the three SIAs. Currently, although the potential presence of UXO precludes active natural resource management activities from 47 percent of EEAs 1,182 forested acres, this potential for UXO also precludes human impact through development of this acreage (NSFD/NAVFAC 2007b).

Human impacts to the Mainside SIAs would appear most likely at Gambo Creek rather than the Forested Swale. Gambo Creek is centrally located on Mainside and divides Mainside into two portions. Numerous IR sites are near or within this SIA; some of the range boundaries also overlap with this SIA boundary. Three of the IR sites with potential for residual MCs discussed previously occur in or near Gambo Creek. In addition, this is the largest SIA, easily encompassing more acreage than the other four SIAs combined. Lastly, surface water flow would influence contaminant dispersion to a much greater degree in this SIA than any of the other four SIAs.

5.3.3.6 Cultural Resources

Extensive archaeological survey work has been conducted on Mainside. Due to the presence of restricted areas and safety constraints, subsurface archaeological investigations are prohibited throughout most of the EEA Range (NSFD/NAVFAC 2007b). A total of 18 archaeological sites shown in Figure 5-9 have been documented and determined to be eligible for listing on the National Register. These sites are currently preserved in situ, and no attempts have been made to formally list them on the National Register.

Four historic architectural districts also exist on Mainside (NSFD/NAVFAC 2007b) and are shown in Figure 5-8. Early Dutch colonial architecture mixed with more modern architecture occurs in these districts. The four districts include the airfield (including the airstrip and associated aircraft facilities), the main battery (including the primary major caliber gun emplacements), the residential area (including the majority of historical installation residences), and the wharf area (including the historical docking area along Upper Machodoc Creek linking the waterway with the Main Battery via rail and road).

FIGURE 5-9. NAVAL SUPPORT FACILITY DAHLGREN SPECIAL INTEREST AREAS

5.3.3.7 Groundwater and Surface Water Quality

Groundwater from shallow Columbia aquifer underlying Mainside (median depth of 2 to 20 feet BLS) is likely modestly impacted by range and off-range activities. The aquifer is not used as a potable water source on-site and is segregated by multiple clay confining units from the drinking water aquifer. However, shallow groundwater from the Columbia discharges to marsh areas and surface water streams, including the Potomac River. As shown in Figure 5-10, groundwater characterization wells positioned on the perimeter of the Mainside and EEA Ranges could be used to detect releases to groundwater at the NSFD boundaries if needed. Explosives releases to groundwater have been reported from Site 2 (Fenced Ordnance Burial Area) located at the western boundary of the Missile Test Range. The burial area was used to dispose of excess munitions. Concentrations of 1,3-DNB (0.19 µg/L); 2-nitrotoluene (NT) (1.1 µg/L); 4-NT (3.5 µg/L); HMX (1.9 µg/L); and RDX (0.2 µg/L) were reported in October 2005. Site 2 has undergone a removal action and is currently in LTM. Site 2 is located immediately north of Gambo Creek. Historical releases from range-adjacent sites, including IR Site 16 (1.2 Mgal #2 Fuel Oil tank) and IR Site 12 (Chemical Burn Area), indicate the potential presence of fuel (Site 16), volatile organic compounds (VOCs), and MEC (Site 12) in groundwater. Site 12 is currently undergoing air sparging/soil vapor extraction remediation. Site 16 was remediated by removing the tank and contaminated soil and installing groundwater monitoring wells and a pump and treat system to remove residual contaminants per VDEQ. VOCs detected in Site 12 groundwater consist of 1,1,2,2-tetrachloroethane (TCA) (2 µg/L), 1,1-dichloroethane (DCA) (1 to 11,000 µg/L), 1,1-dichloroethene (DCE) (1 to 6,200 µg/L), 1,1,1-TCA (1 to 100,000 µg/L), and toluene (1 to 1,700 µg/L). MEC in groundwater consisted of RDX (1.2 to 4.7 µg/L). Sites 12 and 16 are located in the Gambo Creek drainage area. Environmental releases from the sites would be transported via Gambo Creek (NSWC 1997a and 1997b; NAVFAC 2005).

Because of the nature of the materials utilized in weapons testing and the residual waste products (e.g., munitions debris), NSFD and NSWCDL have voluntarily tested for perchlorate in surface water, groundwater, soil, drinking water, and sediment to assess possible releases to the environment associated with site activities. Sampling for perchlorate was initiated in 2001 and is ongoing. GPS for perchlorate in groundwater from the shallow aquifer at the OB/OD units has been negotiated with VDEQ and the current DOD level of concern for managing perchlorate is 24 µg/L (DOD 2006). Perchlorate has not been detected in the drinking water at Dahlgren. NSWCDL holds a RCRA Part B Permit for the Thermal Treatment of Hazardous waste by OB/OD that was issued by VDEQ. As shown in Table 5-14 (NSWC 2006), elevated perchlorate concentrations have been detected predominantly in the groundwater near the OB/OD units. Therefore, EEA presently poses the greatest source for perchlorate release to the environment.

TABLE 5-14. RANGE AND FREQUENCY OF PERCHLORATE DETECTIONS IN ENVIRONMENTAL MEDIA

Media	Concentrations (µg/L)			Number of Samples	Number of Detects
	Minimum	Maximum	Average[a]		
Groundwater (OB/OD)	ND	2,700	237.9	118	92*
Groundwater (EEA)	ND	1.0	0.29	7	2
Groundwater (other)	ND	20	2.01	104	32
Surface Water	ND	230	11.5	28	11
Sediment	ND	120	[b]	25	1
Soil	ND	1,200	[b]	111	9
Drinking Water	ND	ND	ND	4	0

[a] Non-detects taken at half the detection level in calculated average.

[b] Average not calculated because of predominance of nondetections and wide range in detection levels.

* 27 of 92 detects exceeded the GPS

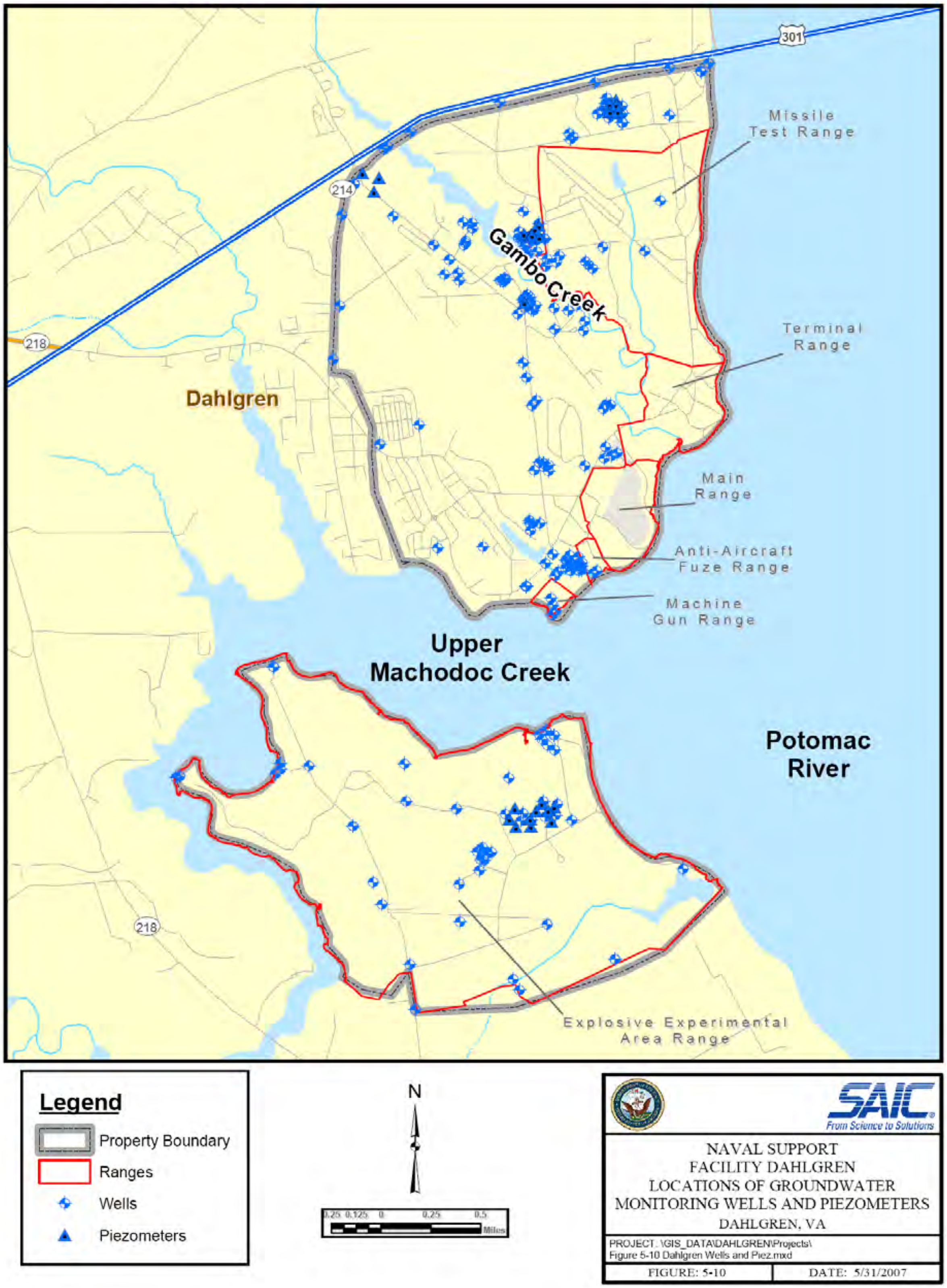


FIGURE 5-10. NAVAL SUPPORT FACILITY DAHLGREN LOCATIONS OF GROUNDWATER MONITORING WELLS AND PIEZOMETERS

Land Use Component

The following sections describe land use on and around the land-based components of the Mainside and EEA Ranges. Prior to naval activities, the property consisted of open farmland with few forested areas and no utilities or infrastructure were present (NSFD/NAVFAC 2007b). Housing, RDT&E operations, support facilities, administration, community use and personnel support, and undeveloped open space are the existing land uses at NSFD. Most of the developed land uses exist on Mainside. Current and future land use are subject to a number of constraints including Explosive Safety Quantity Distance (ESQD) arcs, safety zones, airfield approaches, rare species habitat, and protected wetlands. There are additional constraints discussed elsewhere in this RCA resulting from past land uses, including munitions contamination and hazardous waste sites. Future land use planning is also subject to the conservation of natural and cultural resources (NSFD/NAVFAC 2007b).

Land surrounding NSFD is commercial and residential to the west of the Mainside Ranges and south of the EEA Range. The Potomac River forms the eastern boundary of Mainside and EEA. Upper Machodoc Creek forms the southern boundary of Mainside and the northern boundary of EEA.

5.3.3.8 Mainside Ranges

The naval base at Dahlgren has been operated by the U.S. Navy since 1918. As discussed previously, NSFD is divided into two areas separated geographically by the Upper Machodoc Creek. Mainside is the northern area that encompasses 2,678 acres and is used for operational and support activities, and military housing (NSFD/NAVFAC 2007b).

Military Use

Mainside Ranges include a gunnery complex that faces downriver, with 42 gun emplacements capable of firing all types of naval guns up to and including 16-inch guns, which are no longer fired (Navy 2004a). The following bullets summarize descriptions from the Range Management Plan (NSWCDL 2007b) regarding the major activities conducted at the five land-based ranges on Mainside:

- ***AA Fuze Range***—This range provides a naval environment for guns and ammunition components testing.
- ***Machine Gun Range***—This range is used for testing and small arms as well as penetration testing of light armor materials.
- ***Main Range***—This range is used for systems integration and testing with networked connectivity to most shipboard combat system elements.
- ***Missile Test Range***—This range is used to conduct overland test and evaluation of vehicles and special weapon components against targets.
- ***Terminal Range***—This range supports RDT&E and production testing of weapon systems, components and other ordnance material, specifically experimental items.

There are over 500 administrative, operations, and miscellaneous purpose structures on NSFD. Most of the buildings occur on Mainside (NSFD/NAVFAC 2007b). The southern portion of Mainside also includes an airfield exceeding 6 acres of pavement.

Public Use

NSFD is open to installation personnel and guests only (NSFD/NAVFAC 2007b). There are a variety of outdoor consumptive and nonconsumptive recreational activities available on Mainside. Consumptive recreation is limited to hunting, fishing, and trapping. The primary game species for hunting includes white-tailed deer, wild turkey, quail, rabbit, dove, and squirrel. Testing schedules and bald eagle nesting activities may cause changes to the areas open to hunting. Mainside has nine game compartments for hunting. Fishing is permitted on Mainside in Hideaway Pond, Cooling Pond, Gambo Creek, Upper Machodoc Creek, and the Potomac River (NSASP 2007).

The nonconsumptive outdoor recreation activities include walking, jogging, bicycling, camping, hiking, birding, wildlife viewing, picnicking, canoeing, boating, and archery. Access to various outdoor recreational activities is limited based on time of day, day of the week, and time of the year (NSFD/NAVFAC 2007b).

Timber is actively managed on Mainside for long-term sustainability with an aim on multiple use and habitat management (NSFD/NAVFAC 2007b).

5.3.3.9 EEA Range

The second area with ranges on NSFD is the EEA Range, otherwise known as Pumpkin Neck or EEA. EEA is south of Upper Machodoc Creek, contains 1,641 acres, and is located on Tetotum Flats.

Military Use

The EEA Range contains the Churchill (125 acres) and Harris (50 acres) Ranges and some scattered testing facilities. Although not specifically designated as ranges, the OB/OD units located in EEA also are included in this RCA. Open testing and slow cook-off are some of the various explosive testing and experimental procedures conducted at these ranges (NSFD/NAVFAC 2007b).

Public Use

NSFD is open to installation personnel and guests only (NSFD/NAVFAC 2007b). Although there are a variety of consumptive and nonconsumptive recreational activities available on Mainside, few of these opportunities occur at EEA. There are four game compartments for hunting at EEA, but the open hunting areas can be subject to change based on testing and bald eagle nesting activities. No fishing is permitted on EEA. Recreational and commercial boating does occur within the waters off the coast of the range.

In a similar manner to the consumptive recreational activities, the nonconsumptive activities are more limited at EEA than Mainside.

Timber is actively managed on EEA for long-term sustainability with an aim on multiple use and habitat management (NSFD/NAVFAC 2007b).

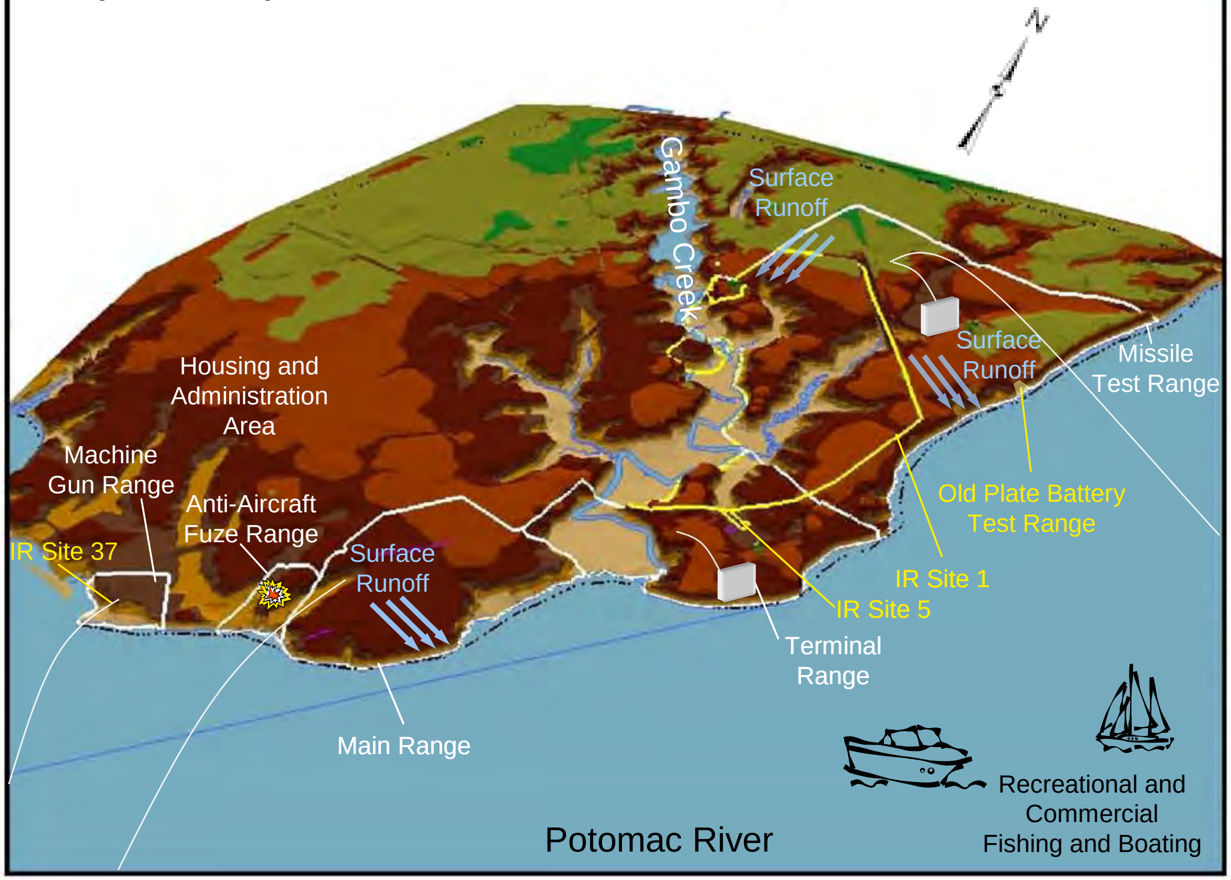
5.3.4 Summary

Prior sections presented the three components of the NSWCDL range ORSMs: operational, environmental, and land use. This section integrates these three components into the ORSMs for the Mainside and EEA Ranges.

5.3.4.1 ORSM for Mainside Ranges

Mainside is the northern area of NSFD that encompasses 2,678 acres and is used for operational and support activities, and military housing (NSFD/NAVFAC 2007b). The five land-based ranges on Mainside include the AA Fuze Range, Machine Gun Range, Main Range, Missile Test Range, and Terminal Range. Figure 5-11 illustrates the ORSM for Mainside. The following summarizes and depicts the source areas (operational component), potential transport pathways (environmental component), and receptors (land use component):

- **Machine Gun Range:** 40-mm and smaller projectiles (with a spot for a 3-inch gun) used to test armor; all projectiles are collected in sand-filled backstops or fired into the Potomac River Test Range
- **Anti-Aircraft Fuze Range:** Test firings of explosive-loaded and fuzed projectiles up to 8 inches; include gun barrel testing during malfunction investigations
- **Main Range:** 20-mm to 16-inch projectiles fired from 42 gun emplacements into Potomac River Test Range; 16-inch guns no longer used
- **Terminal Range:** 3- to 16-inch projectiles and smooth bore items up to 24 inches fired at armor plates, berms, and concrete blocks; some fired into Potomac River Test Range
- **Missile Test Range:** Up to 6-inch projectiles fired at armor plates, berms, and concrete blocks and into Potomac River Test Range; missiles no longer fired here



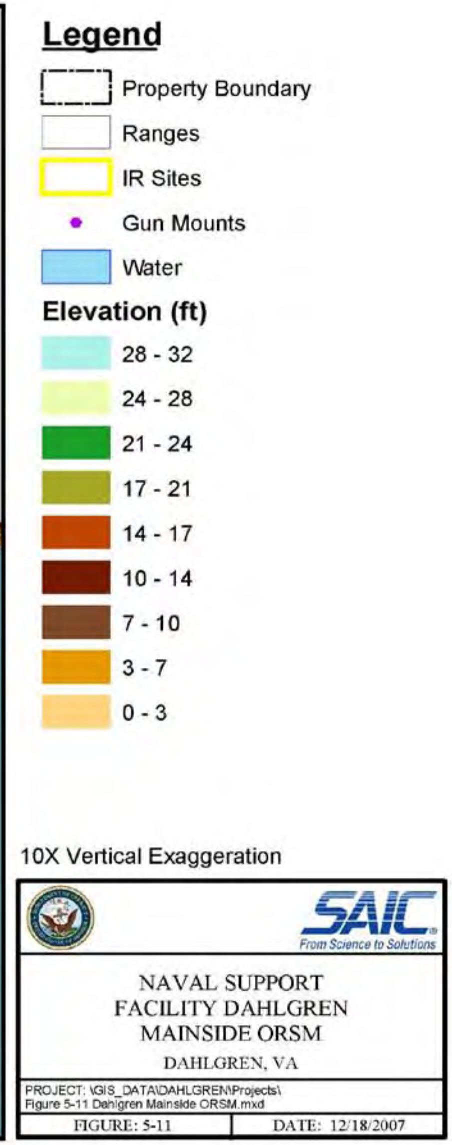


FIGURE 5-11. NAVAL SUPPORT FACILITY DAHLGREN MAINSIDE ORSM

- ***Operational***—Military testing operations began at Dahlgren in 1918. Historical areas where munitions and munitions components were used and disposed of have been characterized and addressed under the success of the IRP. However, the munitions concerns at IR Site 1 (Old Bombing Range) and IR Site 5 (Projectile Disposal Area) have not been addressed and are awaiting evaluation. Remedial action was completed at IR Site 37 (Lead Contamination Area) (NSWC 2007). IR Site 2 (Fenced Ordnance Burial Area) is undergoing LTM, but metals, explosives, and hydrocarbons have been detected in groundwater, although below screening criteria. Finally, stabilization is planned for an area on the Missile Test Range known as the Old Plate Battery Test Area. Current and future operations are consistent with other range use. Munitions debris near target butts and concrete blocks is maintained to the extent needed for safe working conditions and residual munitions components are addressed during maintenance, retrofitting, or replacing targets. Although thousands of munitions have been fired into PRTR from Mainside land-based ranges (6,297 rounds in 2006), only a fraction were HE rounds (approximately 18 percent in 2006). Firing points could potentially release propellant residues off the land-based operational ranges, but the residues would likely migrate into the PRTR where they would be virtually undetectable.
- ***Environmental***—Mainside is characterized by low relief, with elevations ranging from sea level to 24 feet above msl. Some steeper slopes are located along sections of installation watercourses and shorelines. There are five principal surface water bodies associated with NSFD: Potomac River, Upper Machodoc Creek, Gambo Creek, Hideaway Pond, and Cooling Pond. Gambo Creek bisects Mainside and separates the operational ranges from the housing areas and other undeveloped areas of NSFD. Many of the historic sites with munitions contamination addressed under the IRP are located in close proximity to Gambo Creek. There are two SIAs on Mainside, which represent areas with unique ecological characteristics and/or high-quality habitat for rare species. Groundwater monitoring has detected explosives and perchlorate in wells, but these wells were not screened in an aquifer used for drinking water.
- ***Land Use***—NSFD is open to installation personnel and guests only (NSFD/NAVFAC 2007b). Uses include RDT&E operations on the ranges; residential use in the southwestern region; and recreational use, including hunting, fishing, walking, jogging, bicycling, camping, hiking, birding, wildlife viewing, picnicking, canoeing, boating, and archery.

5.3.4.2 ORSM for EEA Range

EEA is the southern area of NSFD located south of Upper Machodoc Creek that encompasses 1,641 acres and is used for operational and support activities (NSFD/NAVFAC 2007b). It includes the Churchill and Harris Ranges as well as a permitted OB/OD unit. Figure 5-12 illustrates the ORSM for EEA. The following sections summarize and depict the source areas (operational component), potential transport pathways (environmental component), and receptors (land use component).

- ***Operational***—The OB/OD units located on the EEA include current operations. However, because constituents have been detected and the levels of those detections, the site is conducting monitoring to comply with the RCRA permit requirements.
- ***Environmental***—Like Mainside, EEA is characterized by low relief and steeper slopes located along sections of installation watercourses and shorelines. There are three SIAs at EEA representing areas with unique ecological characteristics and/or high-quality habitat for rare species. Groundwater monitoring has detected explosives and perchlorate in wells, but these wells are in a shallow aquifer not used or suited for drinking water.

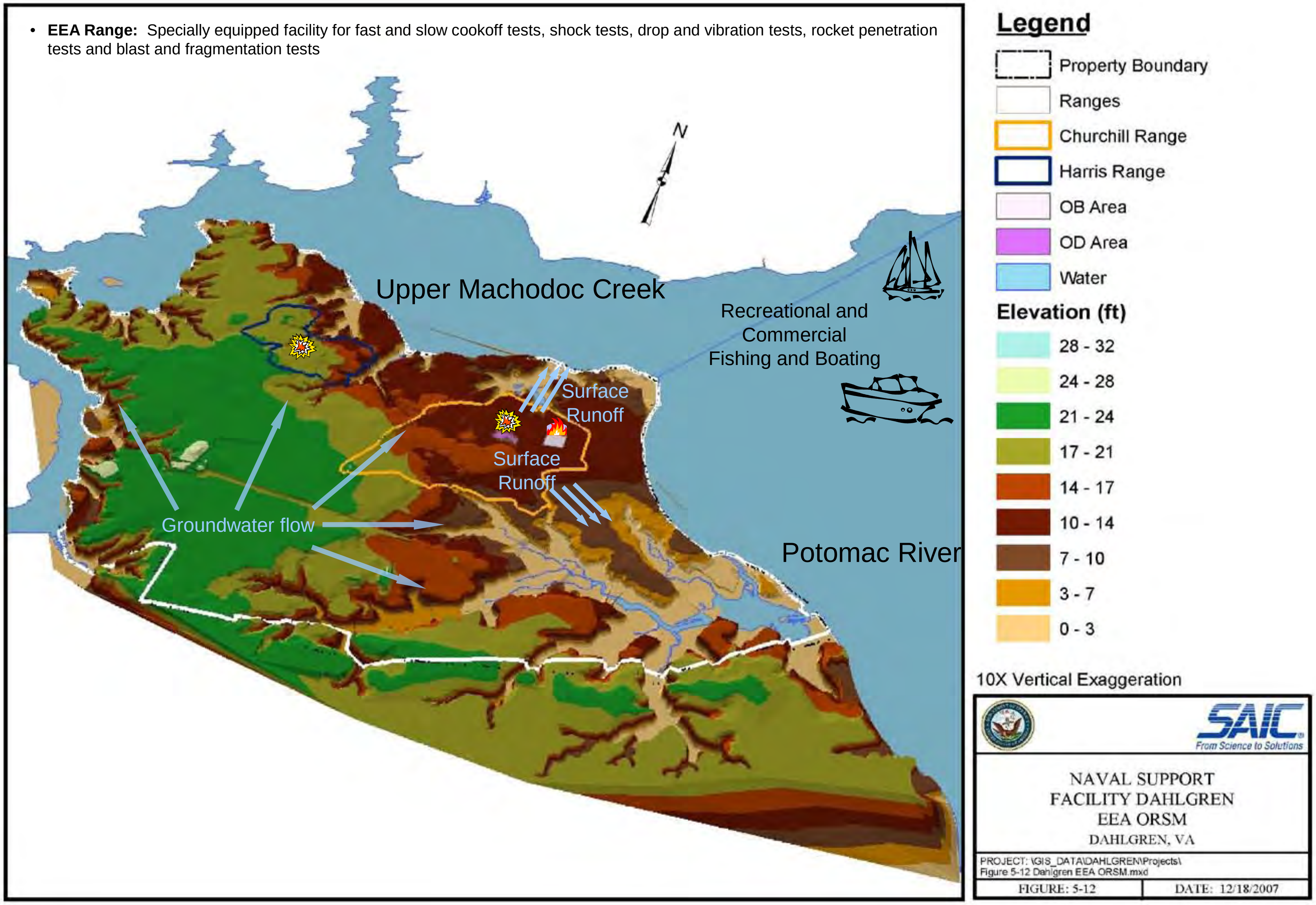


FIGURE 5-12. NAVAL SUPPORT FACILITY DAHLGREN EEA ORSM

- ***Land Use***—NSFD is open to installation personnel and guests only (NSFD/NAVFAC 2007b). Although there are a variety of recreational activities available on Mainside, few of these opportunities occur at EEA. There are four game compartments for hunting at EEA, but the open hunting areas can be subject to change based on testing and bald eagle nesting activities. No fishing is permitted on EEA due to potential UXO issues and range activities. Recreational and commercial boating does occur within the waters off the coast of the range.

5.3.5 Predictive Modeling

Predictive modeling is used to estimate potential concentrations and the migration rates of MCs moving through the environment (air, overland surface flow, subsurface soil, and groundwater migration) when the ORSM demonstrates that the environmental media are potentially impacted. Predictive modeling was not conducted for the Mainside or EEA Ranges due to the extensive sampling and analysis for MCs under the IRP and RCRA and VPDES permit requirements.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

6. DECISION POINT 1

The conclusions presented in this section complete the requirement for the RCA and discuss information necessary to answer Decision Point 1 questions (Navy 2006a) for NSWCDL land-based operational ranges: “Are further steps required to maintain compliance?” and “Is further analysis required to assess risk of off-range release?”

6.1 ARE FURTHER STEPS REQUIRED TO MAINTAIN COMPLIANCE?

Information obtained during RCA Phases II and III was used to answer the first Decision Point 1 question. The results are presented in Sections 4.2 and 5.2, respectively. Section 6.1.1 summarizes the findings of Phases II and III and Section 6.1.2 includes recommendations for identified deficiencies and suggestions to enhance sustainability.

6.1.1 RSEPA Compliance Status Summary

Only environmental regulatory agencies (VDEQ or USEPA) or advisory agencies (e.g., State Historic Preservation Office [SHPO]) can determine legal compliance status, which is normally achieved through regulatory inspections. Many environmental regulations, however, are designed to be “self regulating.” These regulations require internal monitoring and notification of regulatory agencies when potential compliance deficiencies are discovered. In addition, the Navy’s Environmental Quality Assessment (EQA) Program includes self-assessments of environmental compliance.

The environmental compliance deficiencies are classified according to categories found in Chapter 1 of OPNAVINST 5090.1C (Navy 2003).

- ***Minor Deficiency***—Mostly administrative in nature. May involve temporary or occasional instances of noncompliance with environmental statutes.
- ***Major Deficiency***—Requires action, but not necessarily immediately. This category identifies conditions that usually represent violations of environmental statutes and may result in an NOV. Major findings may pose a future threat to human health, safety, the environment, or the ability to accomplish the mission.
- ***Significant Deficiency***—Requires immediate action. These deficiencies pose, or have a high likelihood of posing, a direct and immediate threat to human health, safety, the environment, or the mission of the range.

All deficiencies found by team members during the RCA are outlined in Table 6-1.

The Navy (Navy 2003) has adopted the Office of Management and Budget (OMB) and USEPA classification for categorizing projects based on compliance status. As applied to ranges, these categories are as follows:

- Class I projects are those in which ranges are currently out of compliance with established Federal/state regulatory deadlines.
- Class II projects are those in which ranges will be out of compliance at a specific, impending published deadline if action is not taken. If not accomplished by the deadline, projects become Class I.
- Class III projects are those needed to meet DOD, Assistant Secretary of the Navy (Installations and Environment) (ASN[I&E]), CNO, Fleet Commands, and/or other Echelon II Commands’ goals related to environmental protection, pollution prevention, cost effectiveness, environmental quality, or enhancement initiatives. These requirements are not mandated by law, but demonstrate Federal leadership and goodwill.

TABLE 6-1. SUMMARY OF RSEPA COMPLIANCE STATUS FOR RANGE

Area of Compliance	Statute/Regulation or Defense Requirement	Describe Potential Compliance Deficiency (Specify Location)	Categorize Each Deficiency			Navy Compliance Category
			Significant	Major	Minor	
Air Quality		None				
Water/Wastewater	Virginia Pollutant Discharge Elimination System permit (VA0073636) conditions for industrial areas	Although not completed yet, the industrial wastewater stormwater pollution prevention plan operations and maintenance manual is in the process of being updated to reflect current conditions and relevant team members. This plan was last updated in October 2004.			X	Class I
Cultural Resources	DODI 4715.3	Cultural resources have been identified at NSFD; therefore, an ICRMP should be developed for the proper management and protection of these resources, in addition to addressing SOPs for the potential discovery of previously unidentified resources. ICRMP development began in 2008 and is anticipated to be finalized in early 2009.			X	Class III
Natural Resources	DODI 4715.3	An updated INRMP has been finalized and implemented.			X	Class III
EPCRA		None				
Environmental Planning		None				
Installation Restoration/ Munitions Response		None				
Safe Drinking Water		None				
Safe Drinking Water	Virginia Department of Health Drinking Water Permit Requirements/ OPNAVINST 5090.1B, Chapter 8, 8-5.8	An NOV was issued by the State of Virginia in February 2006 when the permit requirements for the drinking water sampling schedule were not met. Since the NOV was issued, the drinking water has been sampled with no exceedances of the drinking water standards. Corrective action has been taken to ensure that the schedule specified in the permit conditions for sampling are met in the future.			X	Class II
Safe Drinking Water	OPNAVINST 5090.1B, Chapter 8, 8-5.8	The Operations and Maintenance Plan for the public drinking water supply system needs to be updated to reflect current water distribution maps and well locations. This update should include new and removed wells and reflect changes in staffing and responsibilities.			X	Class II
Range Encroachment	OPNAVINST 11010.40	Encroachment Management and Encroachment Partnering Programs should be developed and formalized.			X	Class II

The conclusions for the assessment of environmental compliance are presented for the operational ranges are listed in Table 6-1.

6.1.2 Recommendations/Protective Measures Plan

With few exceptions, the operations conducted on the Mainside and EEA Ranges are in compliance with applicable environmental program requirements. The following recommendations are intended to address the compliance issues listed in Table 6-1. These issues are not expected to adversely impact the daily operations or overall sustainability of the ranges. These compliance issues should be addressed to achieve and maintain compliance with environmental and munitions management requirements and ensure future RDT&E mission success on existing ranges. The following is a discussion of the recommendations:

- ***Water/Wastewater***—NSFD/NAVFAC needs to update the Industrial Wastewater Stormwater Pollution Prevention Plan Operations and Maintenance Manual to meet VPDES permit conditions. Updates are currently underway with completion expected in 2009. Munitions and/or debris that are exposed at the Old Plate Battery Test Area on the Missile Test Range will be stabilized to prevent a potential release of MCs into the PRTR. Although it would not constitute an off-range release, MCs potentially released to the Potomac River could be regulated under COMAR (26.08.01 through 26.08.049). However, when munitions are exposed from past range operations, they will be handled per the ORC to reduce potential risks to human health and/or the environment.
- ***Military Munitions/Solid Waste/Hazardous Materials/Hazardous Waste***—When munitions from range operations as identified in Figure 5-3 are exposed via erosion or other processes, ORC BMPs will be followed to reduce potential risks to human health and/or the environment. EOD will continue to sweep the shoreline at the Old Plate Battery Test Area periodically and after storm events. If munitions become exposed from erosion or other process, they will be removed. Once removed for storage or treatment, they may meet the definition of solid waste in the MR (40 CFR § 266.202(a)(1)(iii), 266.202(c)(2), and 266.202(d)) and will be handled accordingly.
- ***Cultural Resources***—An ICRMP should be completed by NSFD/NAVFAC personnel (DODI 4715.3).
- ***Natural Resources*****—**The INRMP was updated in November 2007.
- ***Environmental Planning***—No recommendations.
- ***Range Environmental and Explosives Safety Management*****—**When munitions from range operations as identified in Figure 5-3 are exposed via erosion or other processes, ORC BMPs will be followed to reduce potential risks to human health and/or the environment. The Navy is presently addressing the shoreline erosion at the Old Plate Battery Test Area by EOD sweeping the area periodically and after storm events, providing signage, developing a shoreline stabilization design, and in the future, stabilizing the shoreline to reduce potential risks to human health and/or the environment.
- ***Installation Restoration (IR)/Munitions Response (MR) Projects*****—**NSFD/NAVFAC is point of contact for all MR and IR sites on NSFD. NSFD also receives requests for munitions response assistance from the local community for which NSWCDL EOD provides off-station support in accordance with a MOU between NSWCDD, NSASP, and King George County. NSWCDL is responsible for the execution of compliant recovery, handling, transportation, storage, and the final disposition of MEC, UXO, and DMM within and outside operational ranges.
- ***Storage Tank and POL Management***—No recommendations.

- ***Safe Drinking Water***—The Operations and Maintenance Plan for the public drinking water supply system needs to be updated by NSFD/NAVFAC to reflect current water distribution maps and well locations. This update should include new and removed wells and reflect changes in staffing and responsibilities. Elevated perchlorate detected in environmental media at NSFD may be subject to the UCMR.
- ***Range Encroachment***—The recently finalized NSASP Encroachment Action Plan (EAP) should be implemented to ensure mission sustainment. NSASP is currently leading implementation of the EAP and has identified specific actions for the tenant Commands, including NSWCDL. NSASP will coordinate with NSWCDL to develop Encroachment Management and Encroachment Partnering Programs to proactively identify and manage encroachment issues. However, it is to NSWCDL's advantage to augment these actions as range operations directly impact NSWCDL's mission.
- ***Constituents***—Perchlorate detected in groundwater at the OB/OD on EEA is being investigated in coordination with VDEQ. A GPS for perchlorate has been established for the OB/OD units. Other MCs also have established GPS, including RDX (1.08 µg/L) and HMX (1,800 µg/L).

6.2 IS FURTHER ANALYSIS REQUIRED TO ASSESS RISK OF POTENTIAL OFF-RANGE RELEASE?

Information obtained during RCA Phases II and III was used to answer the second Decision Point 1 question. The results are presented in Section 5.3. Section 6.2.1 summarizes the findings and Section 6.2.2 includes recommendations to address areas with a potential for an off-range release of MCs.

6.2.1 Findings from Existing Data and ORSM

NSFD is divided into two areas separated geographically by the Upper Machodoc Creek. Mainside is the northern area that encompasses 2,678 acres and includes the following ranges: AA Fuze Range, Machine Gun Range, Main Range, Missile Test Range, and Terminal Range. The second area is the EEA Range that lies south of Upper Machodoc Creek and is 1,641 acres. It contains the Churchill and Harris Test Areas as well as the RCRA-permitted OB/OD units.

Mainside Ranges—The Gambo Creek system, including its tributaries, is a prominent feature that has a significant impact on the potential migration of MCs on Mainside. Many of the areas where munitions have been used or disposed of historically are located in proximity to Gambo Creek and its tributaries. Based on the topography and the relative locations of these sites, any potential MCs in surface and subsurface soils would migrate to surface water within the Gambo Creek system or to groundwater, with ultimate transport into the PRTR. As most of the IR sites have been characterized and addressed already, the potential for off-range release of MCs from historical operations is unlikely in most areas. The proximity of the adjacent PRTR further reduces the possibility for off range release. The Old Plate Battery Test Area on the Missile Test Range has not been fully characterized or investigated; however, it appears to be minimal in size, minimal in quantity of MEC, and its proximity to the PRTR indicates any releases through soil or groundwater would most likely migrate toward the PRTR, which does not constitute an off range release.

Current and future operations on Mainside ranges include activities consistent with other ranges. Of the munitions fired into PRTR from Mainside land-based ranges (6,297 rounds in 2006), only a fraction were HE rounds (approximately 18 percent in 2006). Firing points could potentially release propellant residues and residues from friction between the gun barrels, bourrelets, and rotating bands; however, this has not been evidenced. Sampling in a swampy area downgradient from the Terminal Range firing point showed no influence from munitions operations as PAHs were not detected and concentrations of metals potentially associated with munitions usage were detected within background levels.

EEA Range—All IR sites located on the EEA Range have been closed or require NFA. Impacts from historical and ongoing activities at the OB/OD units are monitored through semi-annual groundwater sampling and annual soil sampling. Perchlorate has been detected in groundwater underlying the OB/OD units. However, no drainage from NSFD enters surrounding lands (i.e., it is all directed to either the Potomac River or Upper Machodoc Creek [NSFD/NAVFAC 2007b]) and the Columbia aquifer does not comprise a viable potable water source (USGS 1996).

The conclusions from reviewing the ORSMs for areas where there is a potential for an off-range release of MCs are listed in Table 6-2.

6.2.2 Recommendations/Protective Measures for Off-Range Release

The Navy is already investigating areas and in most cases has already addressed areas where there is a potential for an off-range release of MCs. The following is a discussion of the recommendations:

- ***Old Plate Battery Test Area***—The Navy is presently addressing the shoreline erosion by providing signage, sweeping the shoreline periodically and after storms, developing a shoreline stabilization design, and in the future, stabilizing the shoreline.
- ***EEA Range***—Since no drainage from the EEA Range enters surrounding lands, no additional actions related to surface transport are recommended. The Navy is delineating the extent of groundwater contamination in this area in accordance with VDEQ guidance.

TABLE 6-2. SUMMARY OF POTENTIAL OFF-RANGE RELEASES

Locations of Munitions Testing	Status of Release[a]	Release Pathway[b]	Potential Receptors	Evidence
Missile Test Range – Old Plate Battery Test Area	Documented. Possible.	Soil/surface water/sediment	Ecological and possible trespassers	Site located on operational range. Release of occasional munitions-related debris to beach area on eastern shore of Missile Test Range is documented by the facility and was observed during site tour. The debris source is consistent with past land use (plate battery testing). EOD personnel routinely sweep beach area for munitions following storm events and remove MEC if found. Area on Missile Test Range has not been fully characterized or investigated.
Missile Test Range – IR Site 1 (Old Bombing Range)	Documented.	Soil to groundwater to surface water/sediment	Ecological	Site located on operational range. Development of range is limited by presence of MEC. An 800-acre area on Missile Test Range has been recommended for no action until range is closed or property is transferred.
Terminal Range – IR Site 5 (Projectile Disposal Area)	Documented as suspect.	Soil to groundwater to surface water/sediment	Ecological	Site anecdotally located on operational range consisting of wetland that was filled with rubble, projectiles, and MEC from a World War I munitions mound. Area on Terminal Range has been recommended for no action until range is closed or property is transferred.
Machine Gun Range – IR Site 37 (Lead Contamination Area)	Documented and addressed (NSWC 2007).	Soil/surface water/sediment	Ecological	Site was located on operational range. SVOCs and metals concentrations detected in sediment. Explosives not detected in sediment samples.
EEA – OB/OD	Documented. Site under LTM requirements of RCRA permit.	Soil to groundwater to surface water/ sediment	Ecological	MC detected in site shallow aquifer monitoring wells.

[a] Status of release is
- Documented (e.g., according to historical records search)
- Suspected, but has not yet been documented (e.g., observation of ground disturbance from historical aerial photography)
- Possible (e.g., live-fire impact area uphill from surface water body)
- Unknown.

[b] A release pathway is the environmental medium or matrix through which a contaminant or hazard migrates or contacts a receptor. Environmental pathways typically correspond to the medium where the contaminant is released, and to fate and transport processes following the release. Examples of environmental pathways are groundwater, surface soil, subsurface soil, sediment, surface water, and air. The biotic pathway occurs through uptake, accumulation, or concentration of contaminants by organisms, and subsequent transport of that contaminant through the food chain.

7. REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 2006. Public Health Assessment for Naval Support Facility (NSF) Dahlgren (aka Naval Surface Warfare Center – Dahlgren) Dahlgren, Virginia VDEQ Facility ID: VA71700246. June.

Akhavan, J. 2004. *The Chemistry of Explosives*, The Royal Society of Chemistry (RSC) Paperback. Department of Environmental and Ordnance Systems, Cranfield University, Royal Military College of Science, Swindon NS68LA. Second Edition. Reprinted 2005.

CNO (Chief of Naval Operations). 2006. Encroachment Management Program OPNAVINST 11010.40. Naval instruction is pending signing by CNO.

Dauphin, Larry and C. Doyle. 2000. *Report of Findings for: Study of Ammunition Dud and Low Order Detonation Rates*. Prepared by U.S. Army Defense Ammunition Center, Technology Center for Explosives Safety, McAlester, Oklahoma. Prepared for the U.S. Army Environmental Center, ATTN: SFIM-AEC-ETD, Aberdeen Proving Ground, Maryland. July.

DOD (U.S. Department of Defense). 2006. Policy on DoD Required Actions Related to Perchlorate. January.

DOD. 2007. DoD Materials of Evolving Regulatory Interest Team. Perchlorate Site-Specific Summary for Dahlgren Naval Surface Warfare Center. Online: (https://www.denix.osd.mil/denix/Public/Library/MERIT/Perchlorate/efforts/sites/va/sites/Dahlgren.html)

Earth Tech Inc. 2004. Community Involvement Plan for the Integrated Management Plan Environmental Impact Statement, prepared for Naval Surface Warfare Center, Dahlgren. June

FR (Federal Register). 2007. Volume 72, number 130. Pages 3373-3374. July 7.

Geo-Marine, Inc. 2006. Assessment of Vulnerabilities of Bald Eagles to Outdoor Testing at Naval Support Facility Dahlgren.

Geo-Marine, Inc. 2007. Bald Eagle Management Plan for Naval Support Facility Dahlgren.

McCollum, K.G. 1977. *Dahlgren*. Naval Surface Weapons Center, Dahlgren, Virginia.

Metallurgical Consultants. 2007. http://www.materialsengineer.com/E-Alloying-Steels.htm.

NAVFAC (Naval Facilities Engineering Command). 2005. Environmental Restoration Site Management Plan. Naval District Washington, Dahlgren Site, Dahlgren, VA. June.

NAVFAC. 2007a. Draft Gambo Creek Sediment Sampling, October 2006. Naval Support Facility Dahlgren, Dahlgren, Virginia. Prepared for Naval Facilities Engineering Command Washington under Contract Number N62477-03-D-0163, Delivery Order 010. Prepared by Tetra Tech NUS, Inc. January.

NAVFAC. 2007b. Encroachment Action Plan Naval Support Activity South Potomac. Prepared for Naval Facilities, Washington DC. Prepared by EDAW. August.

Navy. 1983a. Dahlgren Site Ordnance Safety and Operating Procedures. Naval Surface Weapons Center, Dahlgren, Virginia 22448, and Silver Spring, Maryland 21910. 17 June.

Navy. 1983b. Initial Assessment Study of Naval Surface Weapons Center, Dahlgren Laboratory, Dahlgren, Virginia. Naval Energy and Environmental Support Activity (NEESA) 13-005.

NEESA, Port Hueneme, California. Prepared by Fred C. Hart, Associates, Inc. 530 Fifth Avenue, New York, New York. May.

Navy. 1986. Navy Assessment and Control of Installation Pollutants (NACIP) Final Report, Confirmation Studies at the Naval Surface Weapons Center, Dahlgren, Virginia. Prepared by O'Brien and Gere Engineers, Inc., Syracuse, New York under Contract Number P11 N62477-83-C-0013. February.

Navy. 1992. Summary Meeting Minutes Technical Review Committee Meeting. September 28, 1992, Meeting #1. Installation Restoration Program, Remedial Investigation/Feasibility Study, Naval Surface Warfare Center, Dahlgren.

Navy. 1994. Federal Facilities Agreement (Under CERCLA Section 120), United States Environmental Protection Agency, Commonwealth of Virginia, United States Department of the Navy: Naval Surface Warfare Center, Dahlgren Division, Dahlgren, Virginia. September.

Navy. 2000. Navy Closed, Transferred, Transferring, Active, and Inactive Range Survey. January.

Navy. 2003. Environmental and Natural Resources Program Manual. OPNAVINST 5090.1C CH-4. Department of the Navy, Office of the Chief of Naval Operations, Washington DC. 4 June 2003.

Navy. 2004a. Community Involvement Plan for the Integrated Management Plan Environmental Impact Statement. Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia. June.

Navy. 2004b. Operational Range Clearance Policy for Navy Ranges. 3000 Series N43/4U741226. 2 April.

Navy. 2006a. Navy Range Sustainability Environmental Program Assessment (RSEPA) Policy Implementation Manual. Prepared by Chief of Naval Operations, Environmental Readiness Division (N45). Revision 1. August.

Navy. 2006b. NSWCDD/MP-99/46. Prepared by NSWCDL Public Affairs, Ms. Debra Eubanks, Code CD06. www.nswc.navy.mil.

Navy. 2006c. Environmental Restoration Site Management Plan for Naval Support Facility, Dahlgren (NSFD), Dahlgren, Virginia. Prepared by J.M. Waller Associates, Burke, Virginia under Contract Number N62477-03-D-0163, Contract Delivery Order 0010. June.

NRC (National Research Council). 2004. *Advanced Energetic Materials*. Committee on Advanced Energetic Materials and Manufacturing Technologies, National Research Council. ISBN: 0-309-09160-8. This free PDF was downloaded from: http://www.nap.edu/catalog/10918.html.

NSASP. 2007. Hunting Instruction 5090.2. 21 September.

NSFD/NAVFAC (Navy Support Facility Dahlgren/Naval Facilities Engineering Command). 2006. Personal Communication. Interview record taken on November 1, 2006 at Building 180.

NSDF/NAVFAC. 2007a. Assessment of Vulnerabilities of Bald Eagles to Outdoor Testing at Naval Support Facility Dahlgren prepared by Geo-Marine, Inc., Hampton VA. October.

NSFD/NAVFAC. 2007b. Integrated Natural Resources Management Plan, Naval Support Facility Dahlgren prepared by Geo-Marine, Inc., Hampton VA. November.

NSWC (Naval Surface Warfare Center). 1997a. Site 2 Fenced Ordnance Burial Area Record of Decision, Naval Surface Warfare Center Dahlgren Site, Dahlgren, Virginia prepared by NSWC, USEPA Region III, and the Virginia Department of Environmental Quality. September.

NSWC. 1997b. Site 12 Chemical Burn Area Record of Decision, Naval Surface Warfare Center Dahlgren Site, Dahlgren, Virginia prepared by NSWC, USEPA Region III, and the Virginia Department of Environmental Quality. September.

NSWC. 2003. Spill Prevention, Control, and Countermeasures Plan and Tank Management Plan prepared by the Safety and Environmental Office, NSWCDL Dahlgren Site for NAVSEA. April

NSWC. 2005a. Environmental Stewardship – Installation Restoration, A Dahlgren Public Affairs Fact Sheet. July. Hardcopy provided to SAIC by Stacey Courtney on 10 November 2006.

NSWC. 2005b. Dahlgren: A Vital Mission, A Dahlgren Public Affairs Fact Sheet. July. Hardcopy provided to SAIC by Stacey Courtney on 10 November 2006.

NSWC. 2005c. Dahlgren: A Unique National Asset, A Dahlgren Public Affairs Fact Sheet. July. Hardcopy provided to SAIC by Stacey Courtney on 10 November 2006.

NSWC. 2006. Navy Perchlorate Survey, Ad Hoc report prepared for Dahlgren NSWC, Excel summary spreadsheet prepared by V. Lovejoy (NSWC) received by SAIC on 21 December 2006.

NSWC. 2007. Personal communication. Telephone conversation between SAIC and NSWC on December 5, 2007.

NSWC Dahlgren Laboratory (DL). 2006. http://www.nswc.navy.mil/wwwDL/.

NSWCDL. 2007a. Viewgraph entitled, “US NAVY Dahlgren Potomac River Test Range,” presented to Swan Point citizens in March 2007.

NSWCDL. 2007b. Range Management Plan, Naval Surface Warfare Center, Dahlgren Site. NAVSEA Warfare Centers, Dahlgren. December.

Packer, B. 2002. UXO Corrosion in Soil. Presented at the 2002 Partners in Environmental Technology Technical Symposium and Workshop, “Meeting DoDs Environmental Challenges.”

Packer, B. 2004. “Underground UXO: Are They a Significant Source of Explosives In Training Range Soils?” Presented at the U.S. Army Engineering and Support Center, Ordnance and Explosives Stand Down, Huntsville, Alabama. 14 December.

Slover, Gene. 1937. Naval Ordnance 1937, the Naval Proving Ground. http://www.eugeneleeslover.com/NAVAL-ORDNANCE-1937.html

U.S. Army. 1984. *Military Explosives.* Department of the Army Technical Manual (TM) 9-1300-214. Change No. 4. Headquarters, Department of the Army, Washington, DC. September.

USACE (U.S. Army Corps of Engineers). 2006. The Environmental Assessment and Management (TEAM) Guide, Virginia Supplement. Prepared by Carolyn O’Rourke and Peter Heinricher, U.S. Army Engineer Research and Development Center (ERDC), Construction Engineering Research Laboratory (CERL), Champaign, IL. June.

USAEC (U.S. Army Environmental Center). 2006. Background Document Report on Revisions to 5th Edition AP-42, Chapter 15 – Ordnance Detonation Emission Factors Developed Based On Firing Point Emission Study Phase II, Series 5 Testing Conducted at Aberdeen Proving Ground, Maryland. Prepared for the U.S. Army Environmental Center, SFIM-AEC-ATT, Aberdeen Proving Ground, Maryland 21010-5401. July.

USGS (U.S. Geological Survey). 1994. Hydrogeologic and Water-Quality Data for the Main Site, Naval Surface Water Center, Dahlgren Laboratory, Dahlgren, Virginia. U.S. Geological Survey. Open-File

Report 94-301. Prepared in cooperation with the Environmental Division, Naval Surface Warfare Center, Dahlgren Laboratory.

USGS. 1996. Hydrogeology and Water Quality of the Shallow Aquifer System at the Mainside, Naval Surface Warfare Center, Dahlgren Site, Dahlgren Virginia. Water Resources Investigations Report 96-4055. Prepared in cooperation with the Safety and Environmental Office, Naval Surface Warfare Center.

VDEQ (Virginia Department of Environmental Quality). 2007. Personal communication. Electronic mail message from VDEQ to SAIC. Perchlorate Regulation in Virginia. January 25.

Walsh, M.R., Taylor, S., Walsh, M.E., Bigl, S., Bjella, K., Douglas, T., Gelvin, A., Lambert, D., Perron, N., and Saari, S. 2005. Residues from Live Fire Detonations of 155-mm Howitzer Rounds. U.S. Army Engineer Research and Development Center (ERDC), Cold Regions Research and Engineering Laboratory (CRREL), Hanover, New Hampshire. ERDC/CRREL Technical Report (TR)-05-14. July.

APPENDIX A

MANAGEMENT IN-BRIEF

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Navy Range Assessment Program

Ms. Wanda Holmes, PE and Ms. Vickie Writt

8 November 2006

RSEPA Dahlgren Management In-Brief

Agenda

- Why Do RSEPA?
- Tactical Training Theater Assessment and Planning (TAP) Overview and Components
- Range Sustainability Environmental Program Assessment (RSEPA)
- What Will We Be Doing/What Have We Done?

Why Do RSEPA? Drivers

- DOD Directive 4715.11 (Environmental and Explosives Safety Management on Operational Ranges Within the United States)
- DOD Instruction 4715.14 (Operational Range Assessments) – Requires the assessment of all operational ranges
- FY-04 Defense Planning Guidance: Range Management Section – Requires “assessment of potential hazards from off-range migration of MCs and begin remediation by FY2008.”
- Munitions Action Plan (MAP) Objective – USE 01
- Lessons Learned – Vieques, Massachusetts Military Reservation, and Fort Richardson

TAP Overview

- A comprehensive, integrated process to sustain use and access to Navy training and testing ranges/facilities and operating areas by addressing encroachment and environmental compliance issues
  - *Operationally driven*
  - *Mitigate encroachment's impact to planning and execution*
  - *Assess current and future operations, maintenance, and environmental conditions for all ranges and OPAREAS*

TAP Components

- **Range Complex Management Plans**
  - ***Sustainment plans for managing present/future operations, achieving regulatory compliance, implementing mitigation***
- **Environmental Planning Documentation**
  - ***Documents environmental impacts of training operations***
- **Marine Species Density Data**
  - ***Determines population densities and effects on species***
- **Operational Range Clearance**
  - ***Clearance and disposal of ordnance residue***
- **Range Sustainability Environmental Program Assessment**
  - ***Determines environmental impacts of munitions use on ranges***

What is RSEPA?

- A range compliance management process to ensure long-term sustainability using a phased approach
  - *Ensures compliance with applicable regulations*
  - *Identifies and assesses potential for off-range migration at land-based ranges*
- Provides a technically defensible approach for assessing the environmental condition of land-based operational ranges
- Provides a framework for informed decisions about when and how to proceed with a comprehensive assessment and protective measures, if necessary

RSEPA Goals and Objectives

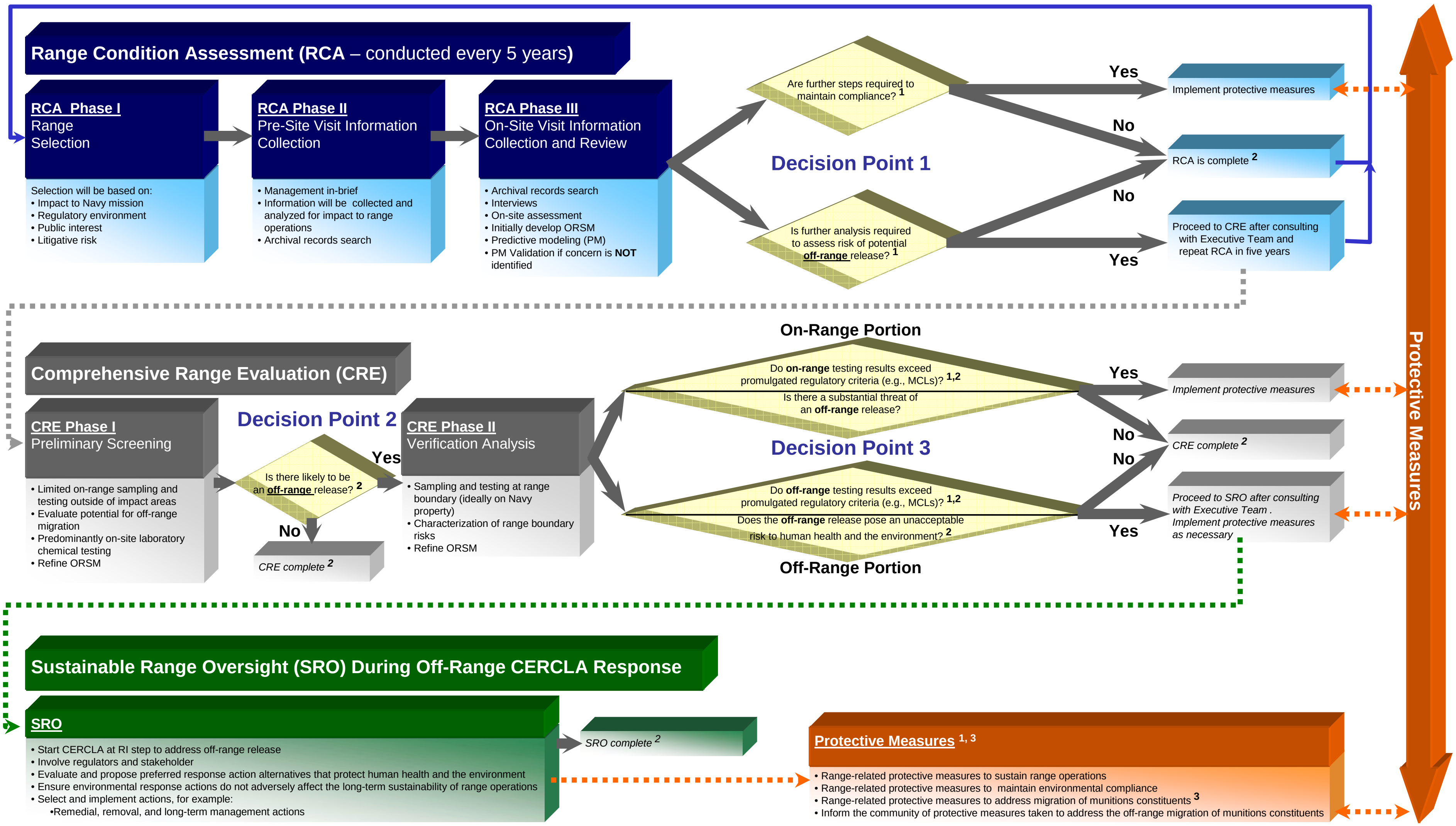
- Evaluate the present (baseline) environmental condition of the range
- Evaluate regulatory status of the range and identify ways to maintain compliance
- Determine challenges to sustainment of range operations related to environmental conditions both on and off range
- Maintain all information collected and assessed in a centralized repository
- Support Navy Range Public Outreach Program and coordinate with operators
- Provide Navy, SYSCOMs, and Fleet leadership with information to make informed range management decisions
- Ensure that the Navy maintains the leading role with regard to range environmental decisions

RSEPA Approach

- **Range Condition Assessment (RCA)**
  - ***An RCA is conducted to determine if steps are necessary to maintain compliance and to determine if further analysis is required to assess a risk of an off-range release. Conduct every five years.***
- **Comprehensive Range Evaluation (CRE)**
  - ***If further analysis is required after the RCA, a CRE will be conducted to verify and confirm if an off-range release of munitions constituents has occurred or if there is significant risk that an off range release could occur.***
- **Sustainable Range Oversight During Off-Range CERCLA Response (SRO)**
  - ***An SRO is conducted in the event an off range release has occurred. The focus of this phase is to ensure range sustainability is maintained while proceeding through the Comprehensive Environmental Restoration, Compensation, and Liability Act (CERCLA) process for off-range releases.***

NAVY RANGE SUSTAINABILITY ENVIRONMENTAL PROGRAM ASSESSMENT (RSEPA)

Process Overview

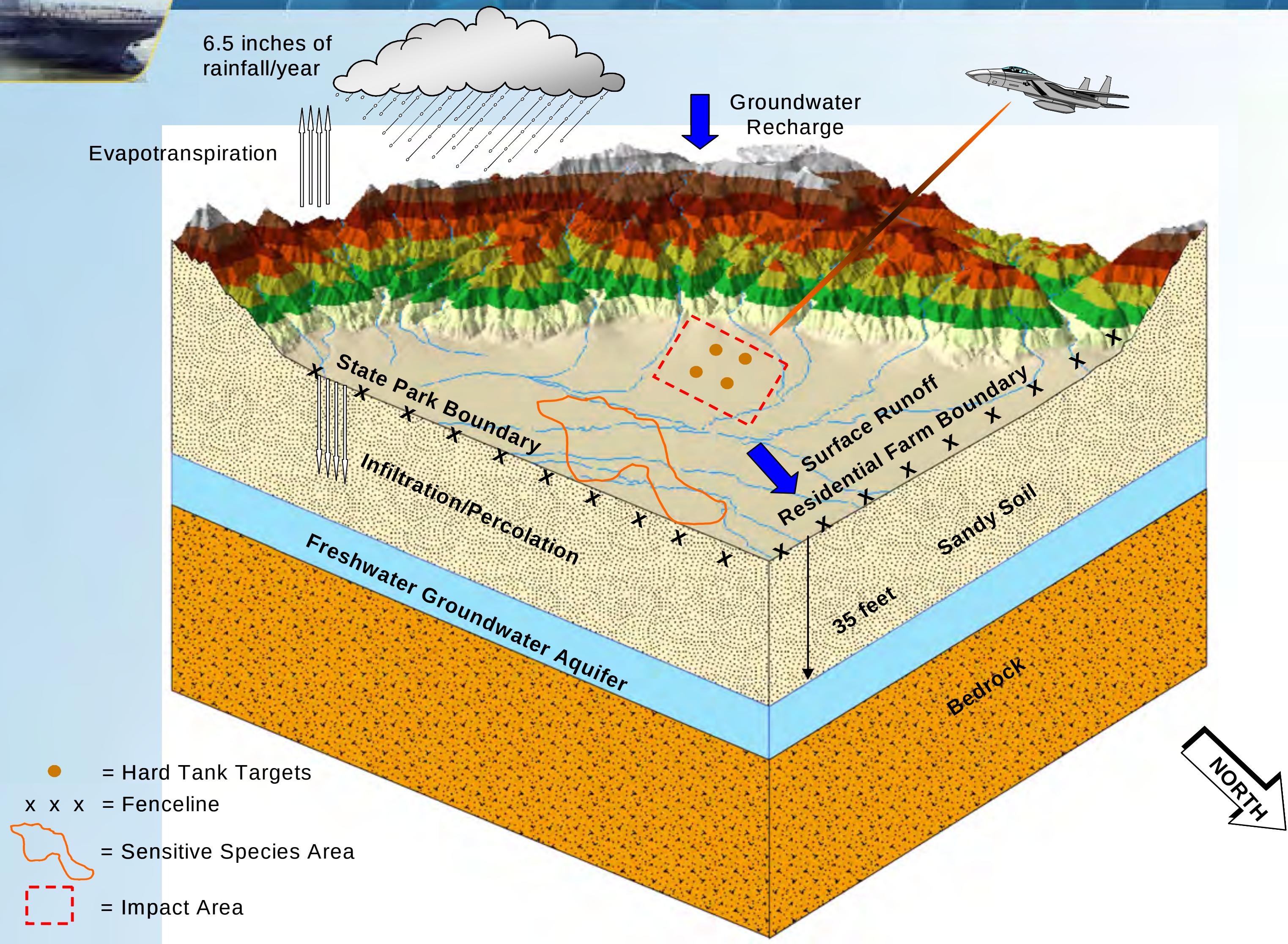


***Notes:** 1. Protective measures can be implemented at any point in the process*
2. RCA will be repeated every 5 years regardless of whether a CRE and/or SRO are conducted
3. Implement concurrently with CERCLA response when applicable

Assessment Process

- Background Research
- On-Site Interviews of Appropriate Personnel (Environmental, Range operators, etc.)
  - *Determine compliance with environmental statutes, etc*
- On-Site Assessment (walk the range)
  - *Confirm background research and fill data gaps*
- Develop Operational Range Site Model (ORSM)
  - *3-D hydrologic and hydrogeological picture of the range*
  - *Conceptual site model*
- Conduct Predictive Modeling
  - *ORSM integrated with range utilization data*
  - *Model potential vertical and horizontal migration of munitions constituents through various environmental media*

Example ORSM



What Will We Be Doing/What Have We Done?

- Meeting with key personnel responsible for range operations to gather information on the following:
  - *General Range Information*
  - *Operational Information*
  - *Environmental Information*
  - *Regulatory Information (as it impacts range operation)*
- Identify applicable legal requirements and environmental conditions of the range
- Identify range operations or management practices past or present that have the potential to result in adverse environmental impacts to the range/impact area and surrounding area

Conclusions

- **RSEPA goals**
  - ***Sustain operations***
  - ***Meet environmental requirements***
- **RSEPA is proactive**
  - ***Assess on-range conditions***
  - ***Preventing off-range impacts to human health and the environment***


US NAVY
Questions?

APPENDIX B

PHASE II – PRE-SITE VISIT INFORMATION COLLECTION

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Table B-1. Range Data Folder, NSWC DL RCA

Title	Date	Version	Preparer	Driver for document (e.g., regulatory requirement, ad hoc basis)	Organization completed for	Person who obtained the document	Document Source	Date Obtained	Document Format	Location of document in Range Data Folder (e.g., folder/subfolder(s)/filename, or office location)	Data Validation	Brief summary of document
Dahlgren Environmental Office GIS layers incl base map and aerial photo	Oct-06	Final	K. Johnson NSWC	IRP/RCRA/POL/MMR	SAIC	Manikas	NSWC	Oct-06	ARCINFO	SAIC GIS system	Yes	ArcView layers/database for NSWC IR site areas; storage tank locations; UXO density; basemap; aerial photo
Master Work Plan for Long Term Monitoring, Naval Support Facility Dahlgren (Waller and Associates September 2006)	Sep-06	Final	JM Waller/TetraTech NUS	CERCLA	NAVFAC	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	N/A	The FSP specifies requirements and procedures for site long-term monitoring activities to be conducted at various sites at the Naval Support Facility Dahlgren (NSF Dahlgren), located in Dahlgren, Virginia. The requirement for monitoring is specified in the Record of Decision specific to each site.
Periodic Groundwater Monitoring Report For Site 9 – Round 4 (TetraTech NUS Inc February 2005)	Feb-05	Final	TetraTechNUS Inc	CERCLA	NAVFAC	Manikas	NSWC	11/1/2006	Hard Copy	SAIC-Reston	Yes	Summary of Round 4 groundwater analytical results for Site 9..
Periodic Groundwater Monitoring Report For Site 2 – Round 5 (TetraTech NUS Inc October 2005)	Oct-05	Final	TetraTechNUS Inc	CERCLA	NAVFAC	Manikas	NSWC	11/1/2006	Hard Copy	SAIC-Reston	Yes	Summary of Round 5 groundwater analytical results for Site 2.
Site 50 Surface Water Investigation Priority 1 Sites Project Work Plan (TetraTech NUS Inc January 2000)	Jan-00	Final	TetraTechNUS Inc	CERCLA / IRP	Nav Fac Engineering Command	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	Yes	The Project Work Plan describes activities to be conducted at Site 50 to generate additional chemical data to resolve a data gap identified in the Site Screening Process Addendum Site 50 Report (B&R Environmental, 1998). Specifically, metal concentrations in surface water samples collected in the marsh adjacent to Site 50 appear elevated but Site 50 is not implicated as the source area for these constituents.
Site Screening Process Addendum Site 50 Report (TetraTech NUS Inc August 2000)	Aug-00	Final	TetraTechNUS Inc	CERCLA	Nav Fac Engineering Command	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	N/A	This document presents the results of additional investigations conducted at Site 50.
Site IO- Hideaway Pond Record of Decision (NAVSEA September 2000)	Sep-00	Final	NSWC	CERCLA	NAVSEA	Manikas	NSWC	11/1/2006	Hard Copy	SAIC-Reston	Yes	ROD (monitoring) for possible mercury contamination of sediments/fish.
EWW FINAL REPORT for Site 2- Fenced Ordnance Burial Area (OHM Remediation Services Corp. February, 1999)	Feb-99	Final	OHM Remediation Services Corp	CERCLA / IRP	NSWC	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	N/A	OHM Remediation Services Corp. (OHM) conducted excavation,consolidation, and remediation of the Fenced Ordnance Burial Area, Site 2. This report summarizes operations performed by OHM.
Site 9 Disposal/Burn Area Record of Decision (NSWC September 1998)	Sep-98	Final	NSWC		USEPA/VDEQ	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	N/A	This ROD is issued to describe the NAVY's selected remedial action for Site 9 Disposal/Burn Area. The selected remedy is to cap landfill soils and marsh sediments.
Addendum Remedial Investigation Report Site 17 (Brown & Root Environmental August 1998)	Aug-98	Final	Brown & Root Environmental	IRP / CLEAN / NCP	Nav Fac Engineering Command	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	Yes	This document presents the results of the continuation of the Phase 2 Remedial Investigation (RI) at Site 17 at the NSWCDL.
Addendum Remedial Investigation Report Site 12 (Brown & Root Environmental July 1997)	Jul-97	Final	Brown & Root Environmental	IRP / CLEAN / NCP	Nav Fac Engineering Command	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	Yes	This document presents the results of the continuation of the Phase 2 Remedial Investigation (RI) at Site 12 at the NSWCDL.
Site 12- Chemical Burn Area Record of Decision (NSWC SEPTEMBER 1997)	Sep-97	Final	NSWC	IRP	USEPA/VDEQ	Manikas	NSWC	11/1/2006	Hard copy	SAIC-Reston	Yes	Record of Decision (Air sparging/SVE) for Site 12
Site 2- Fenced Ordnance Burial Area Record of Decision (NSWC SEPTEMBER 1997)	Sep-97	Final	NSWC	CERCLA	USEPA/VDEQ	Manikas	NSWC	11/1/2006	Hard Copy	SAIC-Reston	Yes	ROD for Site 2 consisting of removal of soils, trenches, debris piles; capping; inst controls for industrial use.
Hydrogeology and Water Quality of the Shallow Aquifer System at the Mainside NSWC (USGS 1996)	1996	Final	USGS	IRP	NSWC-Dahlgren	Manikas	NSWC	11/1/2006	Hard copy	SAIC-Reston	Yes	Hydrogeologic and water quality data collected at NSWC-DL during assessment of shallow aquifer in 1992.
Site Screening Process Priority 2 Sites PHASE II Project Work Plan (Brown & Root Environmental October 1996)	Oct-96	Final	Brown & Root Environmental	RCRA / CLEAN	Nav Fac Engineering Command	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	N/A	Geophysical investigations at Sites 13, 57
Federal Facility Agreement, Appendix B Site Close-out Package AOC A, Otto Fuel Spill (NSWC June 1996)	Jun-96	Final	NSWC	RCRA / FFA	USEPA/VDEQ/NSWC	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	N/A	A desktop evaluation of the site by EPA Region III, VDEQ, U.S. Navy Engineering Field Activity Chesapeake (EFA Ches), and the Naval Surface Warfare Center, Dahlgren. It is the consensus of the RPMs that this site requires no further action under a continued industrial use scenario.
Gambo Creek Ecological Assessment (Brown & Root Environmental July 1996)	Jul-96	Final	Brown & Root Environmental	CERCLA / CLEAN	Nav Fac Engineering Command	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	Yes	Contaminant concentrations in some local areas in the Gambo Creek system are high enough to expect effects to occur to local biota. There is some evidence from the sediment toxicity test results and the macroinvertebrate survey that benthic receptors in downstream areas are being impacted, perhaps from additive effects of diluted contaminants from upstream sources.
SITE SCREENING PROCESS PRIORITY ONE SITES PHASE I INVESTIGATION TECHNICAL MEMORANDUM (Halliburton NUS April 1995)	Apr-95	Final	Halliburton NUS	RCRA / Navy CLEAN	NSWC-Dahlgren	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	N/A	Tech memo documenting geophysical surveys at SWMUs 6,45,47 and AOC X9.

Table B-1. Range Data Folder, NSWC DL RCA (Continued)

Title	Date	Version	Preparer	Driver for document (e.g., regulatory requirement, ad hoc basis)	Organization completed for	Person who obtained the document	Document Source	Date Obtained	Document Format	Location of document in Range Data Folder (e.g., folder/subfolder(s)/filename, or office location)	Data Validation	Brief summary of document
Draft Final Remedial Investigation Report Volume 1,2,3,4 (Brown & Root Environmental September 1995)	Sep-95	Final	Brown & Root Environmental	CERCLA / Navy CLEAN / NCP	NSWC-Dahlgren	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	Yes	RI report for Sites 2, 9, 10, 12, 17, 19, 25, 29
Hydrogeologic and Water Quality Data for the Mainside NSWC (USGS 1994)	1994	Final	USGS	IRP;SPCC	NSWC-Dahlgren	Manikas	NSWC	11/1/2006	Hard copy	SAIC-Reston	Yes	Hydrogeologic and water quality data collected at NSWC-DL during assessment of shallow aquifer in 1993-4.
MERCURY ANALYSIS OF FISH SAMPLES COLLECTED FROM HIDEAWAY POND (USFWS APRIL-JULY 1986)	Jul-86	Final	USFWS	IRP	NSWC	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	Yes	This study was a follow-up to the mercury studies conducted in 1981, 1982 and 1983, to determine if the levels of mercury concentration in the fish were increasing or decreasing.
INITIAL ASSESSMENT STUDY NAVAL SURFACE WEAPONS CENTER/DAHLGREN LABORATORY (Fred C. Hart Associates, Inc. May 1983)	May-83	Final	Fred C. Hart Associates, Inc.	Navy Assessment and Control of Installation Pollutants (NACIP)	NEESA	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	N/A	Based on information from historical records, aerial photographs, field inspections, and personnel interviews, a total of 36 potentially contaminated sites were identified. Each of the sites was evaluated with regard to contamination characteristics, migration pathways, and pollutant receptors.
Mainside Station Map (U.S. Naval Weapons Laboratory 1979)	1979	Final	U.S. Naval Weapons Laboratory	DOD	Dept of Navy	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	N/A	Map of Mainside Test Area circa 1979.
General Development Map Pumpkin Neck Test Area (U.S. Naval Weapons Laboratory 1970)	1970	Final	U.S. Naval Weapons Laboratory	DOD	Dept of Navy	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	N/A	Map of Pumpkin Neck Test Area circa 1970.
Plat of Land Adjacent to Naval Proving Ground (Naval Proving Ground April 1935; rev 1939)	Feb-39	Final	Naval Proving Ground	DOD	Naval Proving Ground	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	N/A	Map of Dahlgren Proving ground cica 1939.
Report to Congress on Sustainable Ranges (Secretary of Defense February 2006)	Feb-06	Final	Office of Sec of Defense	Sect 366 of National Defense Auth Act	U.S. Congress	Manikas	Internet	11/3/2006	PDF	Range Data Folder	N/A	Report to US Congress addressing impacts of encroachment and environmental regulation on operation of millitary installations and ranges.
Environmental Restoration Site Management Plan (Waller and Associates June 2006)	Jun-06	Rev 0	JM Waller Assoc	CERCLA/RCRA -FFA	NAVFAC	Skibinski	NSWC	Jul-06	PDF	Range Data Folder	N/A	Summary of identified sites and actions; planned activities for FY 2006-07.
Site 17 1400 Area Landfill Record of Decision (EPA September 1998)	Sep-98	Final	USEPA	CERCLA	USEPA	Skibinski	NSWC	11/10/2006	PDF	Range Data Folder	N/A	This decision document presents the selected remedial acton for Site 17, 1400 Area Landfill at the Naval Surface Warfare Center, Dahlgren Site (NSWCDL), Dahlgren, Virginia.
Periodic Groundwater Monitoring Report For Site 17 – Round 4 (TetraTech NUS February 2005)	Feb-05	Final	TetraTech NUS	CERCLA/IRP	NAVFAC	Manikas	NSWC	11/1/2006	Hard Copy	SAIC-Reston	Yes	Summary of Round 4 groundwater analytical results for Site 17.
Periodic Groundwater Monitoring Report For Site 17 – Round 5 (TetraTech NUS August 2005)	Aug-05	Final	TetraTech NUS	§9 Virginia Administrative Code 20-80-310	NAVFAC	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	Yes	This report presents the Round 5 groundwater monitoring results and statistical analyses of historical and current chemical data in support of the LTMP for Site 17.
Final Integrated Natural Resources Management Plan NSWC-Dahlgren (October 2001)	Oct-01	Final	NSWC	Sikes Act, 16 U.S.C. 670a; DOD Directive 4700.4	NSWC	Skibinski	NSWC	11/3/2006	Word	Range Data Folder	N/A	The purpose of this INRMP is to meet legal requirements of the Sikes Act and to document the policies and desired future direction of natural resource programs at the NSWCDL in Dahlgren, Virginia.
Public Health Assessment for NSFC- Dahlgren (U.S. Dept HHS JUNE 14, 2006)	Jun-06	Initial/Public	US Dept HHS	CERCLA	USEPA	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	N/A	Agency for Toxic Substances and Disease Registry (ATSDR) conducted a public health assessment (PHA) of the Naval Support Facility (NSF) Dahlgren.
2005 Annual Groundwater Monitoring Report for the Open Burn/Open Detonation Area (TetraTech NUS February 2006)	Feb-06	Final	TetraTech NUS	RCRA	NAVFAC	Skibinski	NSWC	10/10/2006	PDF	Range Data Folder	Yes	This document presents the results of the Groundwater Monitoring Program (GMP) for the Open Burning and Open Detonation (OB/OD) area at the Naval Surface Warfare Center, Dahlgren Site (NSWCDL), located in Dahlgren, Virginia, for the three sampling episodes conducted in 2005.
Spill Prevention, Control, and Countermeasures Plan and Tank Management Plan (NSWC Dahlgren Safety & Environmental Office April 2003)	Apr-03	Final	Safety & Environmental Office -NSWC	40 CFR 112.7	NAVSEA	Skibinski	NSWC	11/26/2006	Word	Range Data Folder -SPCC	N/A	This plan describes the practices and procedures that will be used by the Naval Surface Warfare Center Dahlgren Laboratory (NSWCDL), Dahlgren, Virginia to prevent, control, and/or mitigate releases of oil and related petroleum substances to the environment and to manage existing tanks.
Leases and Licenses spreadsheet (March 2006 update) provided by B. Petrocelli on 11/27/06.	Nov-06	Ad hoc	Larry Minor-NSWC	Naval Instruction 11010.40	NSWC	Manikas	B. Petrocelli-NSWC	11/27/2006	Excel	Range Data Folder-Leases	N/A	Excel spreadsheet summarizing exisitng leases and licenses for NSWC-Dahlgren.
Perchlorate analysis spreadsheet provided by Vanessa Lovejoy on 12/21/06.	Dec-06	Draft	V. Lovejoy- NSWC	N/A	NSWC	Manikas	NSWC	12/21/2006	Excel	Range Data Folder	Yes	Ad hoc Excel spreadsheet summarizing NSWC perchlorate sampling results.
Statement of Work for Encroachment Action Plan for the Dahlgren Site received 11/9/06.	Jul-06	Final	B. Petrocelli-NSWC	Naval Instruction 11010.40	NSWC	Manikas	B. Petrocelli-NSWC	11/9/2006	PDF	Range Data Folder	N/A	The A-E will facilitate the establishment of a comprehensive EAP team to create and evaluate an EAP

Table B-1. Range Data Folder, NSWC DL RCA (Continued)

Title	Date	Version	Preparer	Driver for document (e.g., regulatory requirement, ad hoc basis)	Organization completed for	Person who obtained the document	Document Source	Date Obtained	Document Format	Location of document in Range Data Folder (e.g., folder/subfolder(s)/filename, or office location)	Data Validation	Brief summary of document
Encroachment Management Program OPNAV Instruction 11010.40	Nov-06	Draft	CNO	Naval Instruction 11010.40	US Navy	Manikas	B. Petrocelli-NSWC	11/9/2006	PDF	Range Data Folder	N/A	To establish the Chief of Naval Operations (CNO) Encroachment Management program to ensure operational sustainment for all Navy installations, test and training ranges, air and water operating areas (OPAREAs), special use airspace, and military training routes (MTRs).
Community Involvement Plan for the Integrated Management Plan Environmental Impact Statement (Dept of Navy June 2004)	Jun-04	Final	EarthTech Inc	CERCLA/NEPA	NSWC	Skibinski	NSWC	12/19/2006	PDF	Range Data Folder	N/A	This community involvement plan (CIP) is being prepared for the Navy by Earth Tech, Inc. under contract number N62477-00-D-0059 as the basis for the Navy's public involvement program for the environmental impact statement (EIS) that is being developed pursuant to the National Environmental Policy Act (NEPA) to support the IMP.
Site 25 – Pesticide Rinse Area Record of Decision (September 1999)	Sep-99	Final	NSWC	CERCLA	USEPA/VDEQ	Manikas	NSWC	11/1/2006	Hard copy	SAIC-Reston	Yes	Describes approved action for former pesticide container rinsing area.
Site 36 – Depleted Uranium Mound and Site 49-Depleted Uranium Gun Butt ROD (September 2001)	Sep-01	Final	NSWC	CERCLA	NAVSEA/USEPA/VDEQ	Manikas	NSWC	11/1/2006	Hard copy	SAIC-Reston	Yes	ROD for DU sites 36 and 49
Site 50 – Fill Area Northeast EEA Site Decision Document (July 2003)	Jul-03	Rev 0	NSWC	CERCLA	USEPA/VDEQ	Manikas	NSWC	11/1/2006	Hard copy	SAIC-Reston	Yes	Describes post RA activity at Site 50.
Site 31 – Airplane Park Dump ROD (September 2003)	Sep-03	Final	NSWC	CERCLA	USEPA/VDEQ	Manikas	NSWC	11/1/2006	Hard copy	SAIC-Reston	Yes	Describes approved ROD for former dumping areas.
Site 61b – Gambo Creek Projectile Disposal Area Final Decision Document (Waller & Assoc)		Final	JM Waller Assoc	CERCLA	NSWC	Manikas	NSWC	11/1/2006	Hard copy	SAIC-Reston	Yes	Describes rationale for source material RA at Site 61b.
Managing Noise at Dahlgren Public Affairs Fact Sheet (June 2005)	Jun-05	Final	Dahlgren PA	RAICUZ	NSWC	Manikas	NSWC	11/1/2006	Hard Copy	SAIC-Reston	N/A	Noise monitoring and management at NSWC.
Site 46- Landfill A, Stump Dump Road ROD (September 2001)	Sep-01	Final	NSWC	CERCLA	USEPA/VDEQ	Manikas	NSWC	11/1/2006	Hard Copy	SAIC-Reston	Yes	Describes selected RA for Site 46
USEPA Superfund report for Site 0302862 NSWC-Dahlgren (November 2006)	Nov-06	Final	USEPA	CERCLA	USEPA	Manikas	www.oaspub.epa.gov	11/10/2006	Text	SAIC-Reston	N/A	USEPA CERCLIS description of NSWC site activity.
Site 37 Lead Contamination Area ROD Amendment	August-06	Final	NSWC	CERCLA	Navy/VDEQ	Manikas	NSWC	11/1/2006	Hard copy	SAIC-Reston	Yes	Amendment of 2004 ROD to account for potential presence of MEC.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

APPENDIX C
RCA PHASE III FORMS

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Form 3. RCA On-Range Visit Plan-of-Action

Operating Area Name	Range Complex Name	Range Name(s)
	Dahlgren Naval Surface Warfare Center	Missile Test Range Terminal Range Main Range Anti-Aircraft Fuze Range Machine Gun Range Explosive Experimental Area Range

Summary of Documents Reviewed During Pre-Site Visit Information Collection

1. Administrative Record NSWC DL (documents prepared through September 30, 2000) – 4 CDs
2. Dahlgren Environmental Office GIS layers including base map and aerial photo
3. Master Work Plan for Long Term Monitoring, Naval Support Facility Dahlgren (Waller and Associates September 2006)
4. Periodic Groundwater Monitoring Report For Site 9 – Round 4 (TetraTech NUS Inc February 2005)
5. Periodic Groundwater Monitoring Report For Site 2 – Round 5 (TetraTech NUS Inc October 2005)
6. Site 50 Surface Water Investigation Priority 1 Sites Project Work Plan (TetraTech NUS Inc January 2000)
7. Site Screening Process Addendum Site 50 Report (TetraTech NUS Inc August 2000)
8. Site I0- Hideaway Pond Record of Decision (NAVSEA September 2000)
9. EWW Final Report for Site 2- Fenced Ordnance Burial Area (OHM Remediation Services Corp. February, 1999)
10. Site 9 Disposal/Burn Area Record of Decision (NSWC September 1998)
11. Addendum Remedial Investigation Report Site 17 (Brown & Root Environmental August 1998)
12. Addendum Remedial Investigation Report Site 12 (Brown & Root Environmental July 1997)
13. Site 12- Chemical Burn Area Record of Decision (NSWC SEPTEMBER 1997)
14. Site 2- Fenced Ordnance Burial Area Record of Decision (NSWC SEPTEMBER 1997)
15. Hydrogeology and Water Quality of the Shallow Aquifer System at the Mainside NSWC (USGS 1996)
16. Site Screening Process Priority 2 Sites PHASE II Project Work Plan (Brown & Root Environmental October 1996)
17. Federal Facility Agreement, Appendix B Site Close-out Package AOC A, Otto Fuel Spill (NSWC June 1996)
18. Gambo Creek Ecological Assessment (Brown & Root Environmental July 1996)
19. Site Screening Process Priority One Sites Phase I Investigation Technical Memorandum (Halliburton NUS April 1995)
20. Draft Final Remedial Investigation Report Volume 1,2,3,4 (Brown & Root Environmental September 1995)
21. Hydrogeologic and Water Quality Data for the Mainside NSWC (USGS 1994)
22. Mercury Analysis Of Fish Samples Collected From Hideaway Pond (USFWS APRIL-JULY 1986)
23. Initial Assessment Study Naval Surface Weapons Center/Dahlgren Laboratory (Fred C. Hart Associates, Inc. May 1983)
24. Mainside Station Map (U.S. Naval Weapons Laboratory 1979)
25. General Development Map Pumpkin Neck Test Area (U.S. Naval Weapons Laboratory 1970)
26. Plat of Land Adjacent to Naval Proving Ground (Naval Proving Ground April 1935)
27. USGS Hyrdrogeologic and Water Quality Data for Main Site, NSWC DL (Open File Report 94-301)
28. USGS Hydrogeology and Water Quality of the Shallow Aquifer System at the Mainside, NSWC DL (Water Resources Investigation Report 96-4055)

Personnel to be Interviewed	Date/Time	Phone Number
NSDF Personnel	October 10, 2006; October 13, 2006	

List of Ranges to Visit

1) Missile Test Range, 2) Terminal Range, 3) Main Range, 4) Anti-Aircraft Fuze Range, 5) Machine Gun Range, and 6) Experimental Explosive Aare Range

Form 4. RCA Activity Notification

Operating Area Name	Range Complex Name	Range Name(s)
Dahlgren Naval Surface Warfare Center	Dahlgren Naval Surface Warfare Center	Missile Test Range Terminal Range Main Range Anti-Aircraft Fuze Range Machine Gun Range Explosive Experimental Area Range
Location (Municipality, State):		
Dahlgren, Virginia 22448-5100		
Management Team Members	**Organization**	**Phone Numbers**
	NAVSEA NAVSEA CNO	
Technical Team Members	**Organization**	**Phone Numbers**
	NAVFAC NAVFAC OESO SAIC SAIC SAIC SAIC SAIC	
Arrival/Departure Dates/Times		
Arrival: Monday, October 30, 2006		
Departure: Thursday, November 2, 2006		
Visit Request Submitted		
October 6, 2006		

Form 5. On-Range Visit

Operating Area Name	Range Complex Name	Range Name(s)
	Dahlgren Naval Surface Warfare Center	Missile Test Range Terminal Range Main Range Anti-Aircraft Fuze Range Machine Gun Range Explosive Experimental Area Range

List who was interviewed:

1. Facility Liaison, Range tour guide
2. Air Quality, EPCRA, UST
3. Range Control
4. Installation Restoration
5. EEA
6. EEA
7. EIS
8. MMR/Solid Waste/HazMat, EPCRA; perchlorate
9. Wastewater, Drinking water
10. Drinking water/ Wastewater
11. Natural Resources
12. Range Safety
13. Cultural Resources
14. Range History
15. Range History
16. GIS
17. Encroachment
18. Public Affairs

Form 5. On-Range Visit (continued)

List the information sources that were reviewed

Aerial photographs

Archive Search Reports (ASRs)

Current/past range manuals

Documented interviews with current/past personnel

Environmental assessments/management plans

Geological/Hydrogeological/Geophysical surveys

Historical records (e.g., EOD responses) and other range maintenance and/or munitions clearance information

In addition to the documents obtained at the pre-site visit, the following documents were used for the RCA:

1. Report to Congress on Sustainable Ranges (Secretary of Defense February 2006)
2. Environmental Restoration Site Management Plan (Waller and Associates June 2006)
3. Site17 1400 Area Landfill Record of Decision (EPA September 1998)
4. Periodic Groundwater Monitoring Report For Site 17 – Round 4 (TetraTech NUS February 2005)
5. Periodic Groundwater Monitoring Report For Site 17 – Round 5 (TetraTech NUS August 2005)
6. Final Integrated Natural Resources Management Plan NSWC-Dahlgren (October 2001)
7. Public Health Assessment for NSFC- Dahlgren (U.S. Dept HHS JUNE 14, 2006)
8. 2005 Annual Groundwater Monitoring Report for the Open Burn/Open Detonation Area (TetraTech NUS February 2006)
9. Spill Prevention, Control, and Countermeasures Plan and Tank Management Plan (NSWC Dahlgren Safety & Environmental Office April 2003)
10. Leases and Licenses spreadsheet (March 2006 update) provided by B. Petrocelli on 11/27/06.
11. Perchlorate analysis spreadsheet provided by Vanessa Lovejoy on 12/21/06.
12. Statement of Work for Encroachment Action Plan for the Dahlgren Site received 11/9/06.
13. Encroachment Management Program OPNAV Instruction 11010.40
14. Community Involvement Plan for the Integrated Management Plan Environmental Impact Statement (Dept of Navy June 2004)
15. Site 12 –Chemical Burn Area Record of Decision (September 1997)
16. Periodic Groundwater Monitoring Report for Site 9 – Round 4 (TetraTech NUS February 2005)
17. Site 25 – Pesticide Rinse Area Record of Decision (September 1999)
18. Site 36 – Depleted Uranium Mound and Site 49- Depleted Uranium Gun Butt ROD (September 2001)
19. Site 50 – Fill Area Northeast EEA Site Decision Document (October 2000)
20. Site 31 – Airplane Park Dump ROD (September 2003)
21. Site 61b – Gambo Creek Projectile Disposal Area Final Decision Document (Waller & Assoc)
22. Managing Noise at Dahlgren Public Affairs Fact Sheet (June 2005)
23. Site 46- Landfill A, Stump Dump Road ROD (September 2001)
24. Site 37- Lead Contamination Area ROD (August 2006)
25. USEPA Superfund report for Site 0302862 NSWC-Dahlgren (November 2006)
26. EPCRA TRI Form R (6/27/2006)
27. Industrial Wastewater Stormwater Pollution Prevention Plan Operations and Maintenance Manual (October 26, 2004)
28. VDEQ letter to Navy regarding Reissuance of VPDES Permit No. VA0073636, NSWC DL
29. VDEQ letter to Navy regarding NSWC DL EPA ID No. VA7170024684, Final Permit for Thermal Treatment of Hazardous Waste by Open Burning and Open Detonation (September 30, 2005)
30. VDEQ letter to Navy regarding RCRA Compliance Evaluation Inspection (CEI) of February 24 and March 15, 2006, NSWC DL, EPA ID#VA7170024684 (September 11, 2006)

Form 5. On-Range Visit (continued)

Provide the following summary and background information about the documents received and reviewed	
Title of document	
Date of document	
Version of document (e.g., draft, draft final, final)	
Author of document	
Driver for document (e.g., regulatory requirement, ad hoc basis)	
Organization for which document was completed	
Person who obtained the document	
Who/where document was obtained from	
Date document was obtained	
Format of document (e.g., electronic format or hard copy)	
Location of document in Range Data Folder (e.g., folder/subfolder(s)/filename, or office location)	
Data quality (e.g., were data validated?)	Data from IRP and RCRA assessments were obtained under planning documents including Quality Assurance Project plans approved by regulatory agencies.

During the range tour, the Technical Team will look for evidence of environmental impacts resulting from military testing and training activities. If possible, the Technical Team should obtain recent aerial photography or a fly-over of the range to document range features and potential effects that might not be observable from ground level. Identify which of the following indications of potential environmental impact were observed during the range visit, where these impacts were observed (add map if possible), and describe the extent of the visible impact. In addition to checking which impacts were discovered, provide supporting documentation and explanation (e.g., GPS coordinates, maps, photographs, diagrams, sketches, logs).

- ❑ Chaff
- ❑ Colored surface water
- Craters, shrapnel, munitions fragmentation, etc.
- EOD open burning/open detonation (OB/OD) pits
- ❑ Evidence of discarded military munition (DMM) burials
- ❑ Evidence of low order detonations (i.e., broken open munitions with exposed filler material)
- Stained soil
- ❑ Stressed vegetation
- ❑ Target structures
- Topographic expressions including surface depressions, linear topographic or vegetation features, mounded areas
- ❑ Unexploded ordnance (UXO)

Other: ________________________________

Form 5. On-Range Visit (continued)

List the signs of potential environmental impacts that were discovered/confirmed during the range tour:
1. EEA- Explosives pond ~15' deep; not an IR site. 2. Monitoring wells on perimeter of OB/OD; Airplane Park IR sites (EEA) indicative of potential groundwater impacts. 3. IR Site 12- Chemical Burn Area –observed air sparging remediation activity indicative of existing soil/groundwater impact on area adjacent to Missile Test range. 4. Release of ordnance-related debris to beach area on eastern shore of Missile Test Range was observed during site tour. Site area has been designated as Old Battery Plate Munitions Area. The debris source is a land based burial that is undergoing exposure on the shoreline through bluff erosion. EOD personnel routinely sweep beach area for ordnance following storm events and remove ordnance pieces. Iron oxides (and possibly other metals or munitions constituents) are leaching from the debris components and precipitating on the shore. IR department encountered munitions during incidental trenching associated with adjacent IR site area 47B and estimates that the burial may encompass approximately 2 acres inland extending into the Potomac River Range. **5.** Unresolved site areas including IR Sites 1 and 5 (munitions present on active range) and the recently discovered Old Battery Plate Munitions Area represent munitions related sites with proximity to public access areas (shoreline) and with uncharacterized potential for munitions-related releases to the environment.
List photographs taken during the range tour:
Time and date of picture
Photographer
Description of picture
Location of picture

Table C-1. Photograph Log

Date	Photo Name	Photographer	Description	Location
11/7/2006	73780001.jpg	SAIC	Entrance to Building 455 (Shellhouse)	NSWC DL
11/7/2006	73780002.jpg	SAIC	Cartridges Outside of Main Range Powder Room	Main Range
11/7/2006	73780004.jpg	SAIC	Phalanx Battery Shelter Area Interior	Main Range
11/7/2006	73780005.jpg	SAIC	Phalanx Battery and Shelter Area	Main Range
11/7/2006	73780006.jpg	SAIC	Firing Point 8"/55 Bag Gun	Main Range
11/7/2006	73780008.jpg	SAIC	Main Range Powder Room	Main Range
11/7/2006	73780009.jpg	SAIC	Main Range Powder Room	Main Range
11/7/2006	73780010.jpg	SAIC	Main Range Powder Room	Main Range
11/7/2006	73780011.jpg	SAIC	Main Range Powder Room	Main Range
11/7/2006	73780012.jpg	SAIC	Old Battery Plate Munitions Area-beach erosion	Missile Test Range
11/7/2006	73780013.jpg	SAIC	Old Battery Plate Munitions Area-beach erosion	Missile Test Range
11/7/2006	73780014.jpg	SAIC	Old Battery Plate Munitions Area-beach erosion	Missile Test Range
11/7/2006	73780015.jpg	SAIC	Old Battery Plate Munitions Area-beach erosion	Missile Test Range
11/7/2006	73780016.jpg	SAIC	Old Battery Plate Munitions Area-beach erosion	Missile Test Range
11/7/2006	73780018.jpg	SAIC	Old Battery Plate Munitions Area-beach erosion	Missile Test Range
11/7/2006	73780019.jpg	SAIC	Monitoring Well - OB/OD	EEA Range
11/7/2006	73780020.jpg	SAIC	IR Site 50 – Fill Areas Northeast	EEA Range
11/7/2006	73790001.jpg	SAIC	Display of Ordnance Sizes	Main Range
11/7/2006	73790002.jpg	SAIC	8"/55 MK22 MOD1 Display	Main Range
11/7/2006	73790003.jpg	SAIC	5"/54 MK64 MOD0; 6"/47 MK39 MOD0 Display	Main Range
11/7/2006	73790004.jpg	SAIC	Display of Ordnance Sizes	Main Range
11/7/2006	73790005.jpg	SAIC	Anchor Display	Main Range
11/7/2006	73790006.jpg	SAIC	Larger Projectile display	Main Range
11/7/2006	73790007.jpg	SAIC	Display of Projectile Sizes	Main Range
11/7/2006	73790008.jpg	SAIC	Display of Projectile Sizes	Main Range
11/7/2006	73790009.jpg	SAIC	Old Battery Plate Munitions Area-beach erosion	Missile Test Range
11/7/2006	73790010.jpg	SAIC	MTR Looking out onto Potomac River Range	Missile Test Range
11/7/2006	73790011.jpg	SAIC	Historical Marker	Main Range
11/7/2006	73790012.jpg	SAIC	18"/47 Caliber Gun Barrel	Main Range
11/7/2006	73790014.jpg	SAIC	Main Range Gun Line	Main Range
11/7/2006	73790015.jpg	SAIC	Phalanx Battery	Main Range
11/7/2006	73790016.jpg	SAIC	Machine Gun Test Chamber	Machine Gun Range
11/7/2006	73790017.jpg	SAIC	Machine Gun Test Chamber	Machine Gun Range
11/7/2006	73790018.jpg	SAIC	IR Site 37	Machine Gun Range
11/7/2006	73790019.jpg	SAIC	IR Site 37	Machine Gun Range
11/7/2006	73790020.jpg	SAIC	Slow Cookoff Area	EEA Range
11/7/2006	73790021.jpg	SAIC	Slow Cookoff Area	EEA Range
11/7/2006	73790022.jpg	SAIC	OB Area	EEA Range
11/7/2006	73790023.jpg	SAIC	DU Test Area	EEA Range
11/7/2006	73790024.jpg	SAIC	OD Area	EEA Range
11/7/2006	73790025.jpg	SAIC	Vibration Control Center	EEA Range

Form 6. Air Quality Interview Record

<table>
<tr><th colspan="3">Point of Contact (POC) Information</th></tr>
<tr><td>1. Date: 1 November 2006</td><td>2. Time: 9:00 am</td><td>3. Location: Building 189, 2nd floor conference room</td></tr>
<tr><td colspan="3">4. Tactical Theater Name: Not Applicable</td></tr>
<tr><td colspan="2">5. Range Complex Name: Not Applicable</td><td>6. Range Name: Explosives Experimental Area Range (EEA), Machine Gun Range, Anti-Aircraft Fuse Range, Terminal Range, Missile Test Range</td></tr>
<tr><td colspan="3">7. Name of POC Interviewed:</td></tr>
<tr><td colspan="3">8. POC Title: Environmental Engineer</td></tr>
<tr><td colspan="2">9. E-mail Address:</td><td>10. Phone Number:</td></tr>
<tr><td colspan="3">11. POC Navy Command Affiliation: Naval Surface Warfare Center, Dahlgren Laboratory (NSWC DL)</td></tr>
<tr><td colspan="2">12. Dept./Div./Branch: Safety and Environmental G604</td><td>13. Contractor? (circle) Yes No</td></tr>
<tr><td colspan="3">14. Name and Affiliation of Interviewer: SAIC, RSEPA Technical Team Members</td></tr>
<tr><th colspan="3">Stationary Air Emission Sources</th></tr>
<tr><td colspan="3">15. Is this range in a National Ambient Air Quality Standards nonattainment area? (circle) Yes No</td></tr>
<tr><td colspan="3">16. Are there any stationary emission sources on operational range areas? (circle) Yes No
If no, proceed to question 18. Otherwise, <u>Describe</u>:
There are a number of storage tanks at NSWC DL that are permitted as stationary sources.</td></tr>
<tr><td colspan="3">17. Are stationary emission sources that are located in operation range areas permitted?
(circle) Yes No N/A <u>Describe</u>:</td></tr>
<tr><td colspan="3">18. Do you have any stationary emission sources that are <u>in nonoperational range support areas</u> (i.e., facilities side of range)? (circle) Yes No If no, proceed to question 20.
If yes, list only major range support source types: Generators, Storage Tanks, a Paint Booth.</td></tr>
<tr><td colspan="3">19. Are range support stationary emission sources permitted? (circle) Yes No N/A
If yes, what Federal, State, or local agency administered permit(s)? Commonwealth of Virginia, Department of Environmental Quality, Air Quality Board. Permit number 40307. The 2005 point source criteria pollutant emissions for NSWC DL were: CO 15.27 tons; NO2- 59.42 tons; PM10- 5.26 tons; SO2- 28.85 tons; VOC- 3.56 tons
If no, why are they not permitted?</td></tr>
<tr><td colspan="3">20. Does the range have a CAA Title V Permit? (circle) Yes No
If yes, what stationary emission source type(s) and major source pollutant(s) triggered the Title V permit requirement?
Where is/are the stationary emission source type(s) located?
If no, explain: The Air Emissions inventory did not indicate PTEs that would require Title V Permit or monitoring. It is recommended, however, that the PTE be recalculated periodically to ensure that the new sources added to the list are not causing the PTE level to approach Title V limits. It should be noted that the State of Virginia periodically reviews permitted sources onsite and has not been concerned with the PTE.</td></tr>
<tr><td colspan="3">21. Is the range subject to any source category MACT standards promulgated under CAA Title III (Hazardous Air Pollutants)? (circle) Yes No
Explain:</td></tr>
<tr><td colspan="3">22. Do any OB/OD or other range-related burning activities occur on the range? (circle) Yes No
If yes, does the range have a permit for this activity? (circle) Yes No N/A
If no permit, why not? The State of Virginia has reviewed this process on their biennial air inspection and do not see this activity as an air emissions event requiring a permit. This, however, has not been obtained in writing. In addition, the NSWC DL is not in a nonattainment area.</td></tr>
<tr><td colspan="3">23. Is fugitive dust control an issue on the range? (circle) Yes No Explain: Fugitive dust has not been an issue due to the large amount of vegetation on the land ranges. There have been no noticeable events and no complaints regarding fugitive dust.</td></tr>
<tr><td colspan="3">24. Is this range subject to CAA, Title III, Section 112r, Accidental Release Prevention? (circle) Yes No
If no, please explain why the range is not subject to this Federal regulation:
NSWC DL does not maintain quantities of regulated substances such as Propane, that would trigger the Accidental Release Prevention requirements of 112r.

If yes, does this range participate in a Risk Management Plan (RMP)? (circle) Yes No N/A
Explain:</td></tr>
<tr><td colspan="3">25. Does the Air Quality Office oversee compliance with the Asbestos NESHAPs? (circle) Yes No If no, state what office on base has this responsibility: Public Works is responsible for Asbestos NESHAPs. Public works has conducted an asbestos survey and conducts sampling prior to construction/demolition/remodeling activities.
If yes, for what types of activities has this office submitted Federal Asbestos Abatement Notifications?
Is this office complying with all reporting requirements and deadlines? (circle) Yes No N/A
If yes, proceed to next question. If no, explain noncompliance:</td></tr>
</table>

Form 6. Air Quality Interview Record (continued)

26. Has the range been inspected by an air quality regulatory agency within the past 5 years? (circle) **Yes** No If yes, state name of agency and any deficiencies noted in most recent inspection report: *Commonwealth of Virginia, Department of Environmental Quality, Air Quality Board. No deficiencies noted. This agency visits NSWC DL every 2 years.*
27. Has the range been issued any air quality Notices of Violation (NOVs)? (circle) Yes **No** If yes, who issued the NOV, what was the NOV for, and how is the NOV being resolved?
28. Are there additional applicable air quality regulations that have not yet been addressed during this interview? (circle) Yes **No** If yes, please list applicable regulations and administering agency.
29. Have any Federal, State, or local air quality regulations negatively impacted range operations? (circle) Yes **No** If yes, please state the regulation and negative impacts.
Mobile Air Emission Sources[1]
30. List types of mobile emission sources in operational range areas: *Generators and Storage Tanks – list too long to provide here.*
31. List types of mobile emission sources in nonoperational range support areas: *Generators, Storage Tanks, Paint Booth – list too long to provide here.*
32. Have Federal, State, or local air quality agencies made requirements of mobile emission sources that have impacted range operations? (circle) Yes **No** If yes, please describe:
Air Quality Conformity
33. Are there plans to change the frequency or type of range operations in such a way that would impact air emissions? (circle) Yes **No** If no, go to next question. If yes, has the issue of increased/decreased air emissions been addressed at the Federal, State, or local air quality agency level? (circle) Yes No If yes, describe:
34. Has an air quality conformity applicability study (CAA General Conformity Rule) ever been performed for any activities on this range? (circle) Yes **No** If no, go to question 36. If yes, for what year and action was this done? What major emission sources were included in this analysis?
35. From the conformity applicability study, was a full conformity determination then required? (circle) Yes No If no, explain why no full conformity determination was required: If yes, what was the conclusion of the determination and did the State make any requirements?
Off-Range Release
36. Has the Navy, regulatory agency, or public expressed any concerns regarding toxic air emissions from range operations and their possible negative impact off range? (circle) Yes **No** If yes, please describe:
37. Have any off-range releases of air contaminants occurred that have negatively impacted air quality for the surrounding community or environment? (circle) Yes **No** Explain: *There have been no noticeable off-range releases and no complaints regarding off-range releases of air contaminants.* If yes, describe:
Documents
38. Do you have copies, preferably electronic, of any documents that address range air quality issues including, but not limited to, a Title V permit; mobile emissions calculations; range air quality inspection report; letters from Federal, State, or local air quality regulatory agencies; and conformity applicability and determination documents. List copies of air quality documents obtained:

[1] Examples of mobile emission sources include ground support equipment, motor vehicles, tanks, aircraft over-flights, marine vessels (if applicable), chaff, and live ordnance use.

Form 7. Water/Wastewater Interview Record

Point of Contact (POC) Information		
1. Date: October 31, 2006	2. Time: 10:30 am	3. Location: Building 189, Room 119
4. Tactical Theater Name: Not applicable		
5. Range Complex Name: Not applicable		6. Range Name: Explosive Experimental Area (Pumpkin Neck) Ranges: Harris Range and Churchill Range and Mainside ranges: Main Range (land based portion), Terminal Range, Shock Tube Road Range, Anti-Aircraft (AA) Fuze Range, Machine Gun Range, Missile Test Range
7. Name of POC Interviewed: Environmental Engineer for host command Naval District of Washington [NDW]; Environmental Engineer for Naval Surface Warfare Center, Dahlgren Laboratory [NSWC DL]		
8. POC Title: Environmental Engineer		
9. E-mail Address:		10. Phone Number:
11. POC Navy Command Affiliation: Naval District of Washington (NDW) (Brian Hornaman)		
12. Dept./Div./Branch: Safety and Environmental (HN2W)		13. Contractor? (circle) Yes **No**
14. Name and Affiliation of Interviewer: SAIC, RSEPA Technical Team Members		

Range Surface Water & Groundwater Information

15. Does this range have any groundwater? (circle) **Yes** No

If no, proceed to next question. If yes, what is the depth to groundwater and is the groundwater used for drinking water or irrigation?

The drinking water wells on NSWC DL average 900 feet BLS, with pumps at 700 feet BLS. The deep water wells that draw water from the underlying Potomac Group aquifer provides potable water supply to support the military mission and personnel needs throughout the installation. The groundwater is used as a source of drinking water, as well as irrigation of the golf course. Although the surficial unit (the Nanjemoy Formation) is not a source of drinking water, the surficial unit is about 45 meters thick and is separated from the underlying aquifers by a clay aquiclude that restricts downward movement of groundwater (NOAA 2000).

16. Does the range have any surface water on or nearby the range? (circle) **Yes** No If no, proceed to next question. If yes, describe surface water and uses of surface water by humans or wildlife.

The Potomac River forms the eastern boundary of Dahlgren. Upper Machodoc Creek forms the northern and eastern boundary of the EEA Range (Pumpkin Neck), and Gambo Creek flows from northwest to southeast and forms the western boundary of the Missile Test Range and flows through Terminal Range. In addition, Hideaway Pond is within the Missile Test Range. Wildlife, such as fish and ducks, use these water bodies for breeding and foraging. The water bodies associated with the mainland and the Eastern border of the ranges (Upper Machodoc Creek, Potomac River, and Gambo Creek) are open for fishing. Fish caught from Hideaway Pond may be kept for mounting purposes only due to potential health risks (i.e., high levels of mercury within the water resource area (INRMP 2001)). No water bodies within the EEA Range are open for fishing.

Point Source Discharges

17. Does this range have a Federally Owned Treatment Works (FOTW)? (circle) **Yes** No

If no, proceed to question 18. If yes, answer the following questions about the FOTW:

What is the FOTW average daily flow rate and capacity? *0.72 million gallons per day (MGD) (design Flow)*

Into what body of water does the FOTW discharge? *Upper Machodoc Creek*

Is the collection system to FOTW "combined" (i.e., receives both wastewater and stormwater)? (circle) Yes **No**

How is sewage sludge disposed of? *Two methods are used for sludge disposal: dry sludge is landfilled in the King George's County landfill and liquid sludge is sent to the nearby publicly owned treatment works (POTW), Hopewell Treatment Plant. The liquid sludge is sent offsite for treatment to this POTW as the FOTW on Dahlgren is a relatively small size.*

Does the FOTW have an NPDES, State, or local wastewater discharge permit? (circle) **Yes** No

If yes, state the name of the permit issuing agency and proceed to question 18. *The permit is issued by the Virginia Department of Environmental Quality (DEQ). DEQ has issued VPDES permit Number VA0021067 to the US NSWC.*

If no, explain why the FOTW does not have an NPDES or other wastewater discharge permit (then proceed to question 18):

18. Does this range discharge wastewater into a Publicly Owned Treatment Works (POTW) collection system? (circle) Yes **No** If no, proceed to question 19.

If yes, does this range or any operations on the range have a discharge permit with the POTW? (circle) Yes No

If yes, proceed to next question. If no, briefly explain why the range does not have a POTW discharge permit:

Form 7. Water/Wastewater Interview Record (continued)

19. If applicable, briefly describe the types of discharges the FOTW or POTW receives (i.e., domestic, industrial, stormwater) from this range:

The FOTW receives industrial and domestic wastewater from the installation including facilities within the Missile Test Range, Terminal Range, Main Range, AA Fuze Range and Machine Gun Range. All buildings on the mainland are tied into the FOTW. Barnesfield Park and the visitors' center are located off-post (to the west of the mainland) and have their own septic system to treat wastewater generated at those locations.

There are approximately 5,200 people generating waste water on the mainland that is treated by the FOTW. The FOTW receives domestic (i.e., housing) and industrial (i.e., from operations such as the photography shop) operations. No stormwater discharges is received by the FOTW.

Wastewater generated at EEA (Pumpkin Neck) is not treated by the FOTW. This wastewater, which is generated from the administration building, is treated by a septic system behind the administration building at EEA.

20. Does the FOTW/POTW receive any discharges from military operational range areas? (circle) **Yes** No N/A

If no, proceed to next question. If yes, briefly describe these types of discharges: The FOTW receives discharges from all buildings within the Missile Test Range, Terminal Rage, Main Range, AA Fuze Range and Machine Gun Range.

The EEA Range (Pumpkin Neck), which includes the Churchill and Harris Range, does not contribute to the FOTW. The wastewater that is generated at these sites is primarily sanitary generated from the administration building and is discharged to its own septic system.

21. Does the range have any onsite disposal systems (e.g., spray irrigation, evaporation lagoons, septic tanks)? (circle) **Yes** No If no, proceed to question 22. If yes, describe disposal system:

EEA Range (Pumpkin Neck) discharges its wastewater through a septic system behind the administration building. When necessary, sludge is removed and sent to the POTW (Hopewell) for disposal. No onsite disposal systems are used for the main area of the Installation (which includes the Machine Gun Range, Anti-Aircraft Fuse Range, Terminal Range, and Missile Test Range.)

Is the disposal system permitted? (circle) Yes **No** If yes, what is the type of permit and who is the permitting agency?

22. Does the range have any other Federal, State, or local wastewater discharge permits for point source discharges? (circle) Yes **No** If no, proceed to next question. If yes, state the type of permit, issuing agency, description of discharge, and whether any discharges are from military operational range areas:

NonPoint Source Discharges

23. Does the range have any NPDES, State, or local stormwater discharge permits? (circle) **Yes** No

If no, proceed to next question. If yes, state the type of permit, issuing agency, and sources of stormwater runoff:

*The VPDES (stormwater discharge permit) VA0073636 was issued by the Virginia Department of Environmental Quality (Virginia DEQ). All of the stormwater within the industrial areas is collected and is discharged at **point** sources. The outfalls permitted are described below:*

- *The Main Range has two stormwater outfalls (002 and 003) associated with the gun mount operations (Gun Emplacements) that are permitted through the Virginia DEQ via VPDES permit number VA0073636. Outfall 002 receives storm water runoff from seven below-grade gun mount sumps and discharges to the Upper Machodoc Creek. Only two of the gun mounts are actively used. Outfall 003 receives stormwater runoff from one actively used gun mound sump and discharges to Gambo Creek.*
- *The Terminal range has one stormwater outfall (007) associated with the gun mount operations that is permitted through the Virginia DEQ via VPDES permit number VA0073636. Outfall 007 receives storm water runoff from one active below-grade gun mount sump and discharges to Gambo Creek.*
- *The EEA (Pumpkin Neck) range has two stormwater outfalls (012 and 013) associated with Open Burning (OB)/Open Detonation (OD) operations that are permitted through the Virginia DEQ via VPDES permit number VA0073636. These outfalls are within the Churchill Range Area of the EEA and discharge to a wetland that eventually discharges to Upper Machodoc Creek (013) or the Black Marsh wetland that eventually discharges to the Potomac River (012).*
- *Other point source discharges not associated with military operational range areas include Outfall 004, Outfall 006, and Outfall 009.*
  - *Outfall 004 receives stormwater discharges from a large part of the developed portion of the base, including the Transportation Areas and base housing. This outfall is associated with the Cooling Pond and discharges to Upper Machodoc Creek. An oil water separator is used for this outfall as petroleum products from the fueling and transportation areas may be in the stormwater.*
  - *Outfall 006 receives stormwater discharges from a marina that supports the base river range operations. The support includes very minor boat maintenance in the Yardcraft area. This outfall discharges to Upper Machodoc Creek.*

o *Outfall 009 receives stormwater discharges from an exposed metal storage area and a covered salt dome facility.*

*Note that the above areas describe the NPDES **permitted** outfalls associated with industrial areas and **point source discharges**. For areas that do not have storm water associated with industrial activities, such as the Missile Test Range, stormwater follows the local topography. Stormwater is discharged to the Gambo Creek, wetlands areas, or the Potomac River.*

Form 7. Water/Wastewater Interview Record (continued)

24. Are stormwater discharges from military operational range areas being monitored? (circle) **Yes** No If no, proceed to next question. If yes, state names of operational range areas that are being monitored for stormwater runoff and describe any contaminants in this stormwater: *Outfalls 002, 003, 007, and 012 are being monitored for stormwater runoff. Contaminants monitored in the runoff include quarterly or annual monitoring of petroleum hydrocarbons, copper, and/or total suspended solids. In addition, metals, pesticides, base neutral extractables, volatiles, acid extractables, and miscellaneous constituents are analyzed yearly for outfall 012 (associated with the OB/OD operations).*
25. Does this range have a current Stormwater Pollution Prevention Plan (PPP)? (circle) **Yes** No
26. Are there protective measures in place? (circle) **Yes** No If no, proceed to question 27. If yes, do protective measures extend to military operational range areas? (circle) **Yes** No If no, proceed to question 27. If yes, describe protective measures employed in military operational range areas: *Examples of protective measures (described in more detail in the SWPPP and SPCC) in place include:* • *Weekly inspection of sumps on the main ranges areas* • *Covering of the open burning pan at EEA when not in use to prevent stormwater from coming into contact with constituents* • *Review of any new processes that involve wastewater* • *Quarterly visual inspections of stormwater outfalls as sampling is being conducted* • *Presence of oil/water separator at the Transportation area where trucks are filled*
27. Does this range have a current Spill Prevention, Control, and Countermeasure (SPCC) Plan to prevent spills of oil and hazardous substances into navigable waters? (circle) **Yes** No
28. Does this range have a current Oil and Hazardous Substances Facility Response Plan (FRP)? (circle) Yes **No**
Regulatory Impacts on Range
29. Has the range exceeded any wastewater or stormwater discharge permit limits within the past year? (circle) Yes **No** N/A If no, proceed to next question. If yes, for what analyte(s) did the range exceed its permit limit(s) and what measures are being taken to eliminate future exceedances?
30. Has the range been inspected by a water quality regulatory agency within the past 5 years? (circle) Yes **No** If no, proceed to next question. If yes, state name of agency and any deficiencies noted in most recent inspection report:
31. Has the range been issued any wastewater discharge Notices of Violation (NOVs)? (circle) Yes **No** If no, proceed to next question. If yes, who issued the NOV, what was the NOV for, and how is the NOV being resolved?
32. Are there additional required water quality regulations or plans that have not yet been addressed during this interview? (circle) Yes **No** If yes, list applicable regulations, plans, and administering agency:
33. Have any Federal, State, or local water quality regulations negatively impacted range operations? (circle) Yes **No** If yes, state the regulation and negative impacts:
Off-Range Release
34. Has the Navy, regulatory agency, or public expressed any concerns regarding the off-range migration of munitions residues? (circle) **Yes** No Explain: *Although not discussed during the interview, during the site visit, it was noted that a previously unknown area of buried munitions and debris had been exposed along the eastern shoreline of the mainland within the Missile Test Range during Hurricane Isabel (September 2003). As a result of the storm, large amounts of the shoreline were eroded and continue to erode. Along with the erosion, a cache of buried material including munitions is also being exposed along the shoreline and potentially releasing munitions constituents into the Potomac River. Because the water is used by recreational fishermen when the Potomac River Range is not in use, this cache presents both physical (i.e., human health) and chemical (i.e., water quality) concerns.*
35. Have any off-range releases of MCs of potential concern occurred that have negatively impacted water quality for the surrounding community or environment? (circle) Yes **No*** Explain: **In May 2001, scientists took a number of water and sediment samples at the mouth of Upper Machodoc Creek where it enters the Potomac River. Although analyzed for explosives, no explosive constituents were found in these samples **V**arious metals (aluminum, barium, calcium, thallium, and zinc) were present, but at levels below state and federal surface water quality criteria (June 2005 Fact Sheet). This sampling suggests that off-range releases prior to the sampling (May 2001) have not negatively impacted water quality at the intersection of the mouth of Machodoc Creek and the Potomac River.*
Documents
36. Do you have copies, preferably electronic, of any documents that address water quality issues that impact the range including, but not limited to, Stormwater PPP, annual stormwater reports, water quality inspection report, water or sediment monitoring reports, FRP, or SPCC Plan? *Stormwater PPP , SPCC, VPDES Permit VA0073636, Integrated Natural Resource Management Plan, Environmental Stewardship Installation Restoration Dahlgren Public Affairs Fact Sheet (June 2005)*

Form 8. Military Munitions/Solid Waste/Hazardous Materials/Hazardous Waste Interview Record

Point of Contact (POC) Information		
1. Date: 31 October 2006	2. Time: 0930	3. Location: Building 189
4. Tactical Theater Name: Not applicable		
5. Range Complex Name:		6. Range Name: Explosives Experimental Area Range, Machine Gun Range, Anti-Aircraft Fuze Range, Main Range, Terminal Range, Shock Tube Road Range, and Missile Test Range
7. Name of POC Interviewed: Environmental Programs Manager Naval Surface Warfare Center, Dahlgren Laboratory (NSWC DL)		
8. POC Title: Environmental Protection Specialist		
9. E-mail Address:		10. Phone Number:
11. POC Navy Command Affiliation: NSWC DL		
12. Dept./Div./Branch: Safety and Environmental (HN2W)		13. Contractor? (circle) Yes **No**
14. Name of POC Interviewed:		
15. POC Title:		
16. E-mail Address:		17. Phone Number:
18. POC Navy Command Affiliation:		
19. Dept./Div./Branch:		20. Contractor? (circle) Yes No
21. Name and Affiliation of Interviewer:		

Military Munitions[1]

Questions 22 - 30 below, regarding military munitions, will need to be addressed by both environmental and range managers. Answer questions with respect to the individual roles of range and environmental managers and describe instances when range and environmental managers work together in the management of military munitions.

22. Describe the handling and storage practices for unused munitions:
Unused munitions transported on site through Shellhouse. Stored in ammunition storage bunkers that are inspected monthly by Lovejoy and Patteson.

23. What is done with unused munitions that are deemed defective or damaged? *EOD determines whether to blow in place or move item(s) to OD area at EEA.*

24. Once munitions have been used for their "intended purposes" (i.e., fired, jettisoned, dropped, launched, detonated on range, or otherwise used), what is done with any resulting munitions fragments (e.g., shrapnel, fins, casings)?
On Mainside ranges, EOD or contractors clear areas during refurbishment of armor plate, berm, and concrete block targets. On EEA, fragments are recovered for forensic analysis (e.g., blast patterns).

25. Describe the process for recycling used munitions fragments:
Items are certified by EOD, stored in a secured area, and transported offsite to DRMO.

26. If used munitions fragments are transported off range to an approved munitions recycling facility (such as a military depot), are they ever manifested? If so, under what circumstances are they manifested?
Yes. Manifest required by DRMO.

27. Describe range maintenance practices with regard to UXO.
On Mainside ranges, EOD or contractors clear areas during refurbishment of armor plate, berm, and concrete block targets. On EEA, fragments are recovered for forensic analysis (e.g., blast patterns).

28. Describe the process for responding to fired munitions that have landed off range.
According to interviewees, this has only been known to happen once and it was many years ago. EOD is involved in all tests that involve the use of explosives, so they would respond to any incidents as necessary.

29. Are you aware of used or unused munitions being buried for disposal purposes? (circle) **Yes** No
Explain: See table below:

IR Site Number	Site Name	Size (acre)	Range/Location	Status
Undesignated	Old Battery Plate Munitions Area	Unknown	Missile Test Range	Awaiting designation in IRP or MRP
2	Fenced Ordnance Burial Area	4.70	Missile Test Range	ROD/RA complete; LTM
5	Projectile Disposal Area	0.82	Terminal Range	Seeking transfer to MRP
9	Disposal/Burn Area	7.91	West of Missile Test Range	ROD; LTM; Wetland monitoring
17	1400 Area Landfill	7.58	North of Missile Test Range	ROD; LTM
44	Rocket Motor Pit	0.03	West of Missile Test Range	NFA
47A	World War I Munitions Mound	0.63	Missile Test Range	EE/CA RA complete
57	Shell House Dump	1.87	West of Missile Test Range	SSP complete
61A	Gambo Creek Ash Dump	2.13	West of Missile Test Range	RI/FS complete; SSP complete
61B	Gambo Creek Projectile Disposal	0.18	Terminal Range	Closed

Form 8. Military Munitions/Solid Waste/Hazardous Materials/Hazardous Waste Interview Record (continued)

30. Does the range keep permanent EOD off-range response records? (circle) **Yes** No
Solid Waste
31. Does this range have a landfill? (circle) **Yes** No If no, proceed to next question. If yes, what types of waste does this landfill accept and where is the landfill located? *Closed landfill. Multiple types of waste including some hazardous wastes.*
32. Describe any solid wastes (as defined under RCRA) that are generated from the range and what is done with them: Dunnage from ammunition boxes.
Hazardous Materials
33. Does this range participate in a Hazardous Material Control and Management (HMC&M) Plan, Authorized Users List (AUL), and a Hazard Communication (HAZCOM) program (required of Navy ranges)? (circle) **Yes** No If yes, proceed to next question. If no, explain why the range does not participate in these HM management programs.
34. Has this range submitted a toxics release inventory (TRI) report under SARA, Title III EPCRA reporting requirements? (circle) Yes No If yes, proceed to EPCRA Interview Form 11, if appropriate. *A form R was submitted for EEA (Pumpkin Neck). Because the quantities of toxic chemicals did not meet threshold reporting requirements for the Mainside, no form was submitted for this area (see Form 11).* Is the range exempt from EPCRA reporting requirements? (circle) Yes **No** If no, explain why the range has not submitted a TRI report:
Hazardous Waste
35. Does this range generate HW? (circle) **Yes** No If no, proceed to question 37. If yes, briefly list what types of HW are generated from the range: *Off spec explosives and propellants disposed of at OB/OD area.*
36. What classification of HW generator is this range?[2] (circle) **Class I** Class II Class III
37. Does this range store HW onsite prior to disposal? (circle) **Yes** No N/A If no, proceed to question 39. If yes, does the range have satellite accumulation points? (circle) **Yes** No
38. Is this range in compliance with all Federal, State, or local HW accumulation time periods? (circle) **Yes** No N/A If yes, proceed to next question. If no, describe deficiency and what is being done to resolve it:
39. Does this range dispose of HW onsite? (circle) **Yes** No N/A If no, proceed to next question. If yes, briefly describe what HW is disposed of onsite and the disposal method: OB/OD under RCRA permit.
40. Does this range have a Treatment, Storage, and Disposal Facility (TSDF) Permit? (circle) Yes **No** N/A If yes, proceed to question 41. If no, is the range considered to fall under a TSDF permit (under an affiliated Navy base)? (circle) Yes **No** N/A If yes, proceed to question 41. If no, explain why not and proceed to question 42:
41. Is this range in compliance with all TSDF permit requirements? (circle) Yes No **N/A** If yes, proceed to question 42. If no, describe deficiency and what is being done to resolve it:
42. Has all HW been disposed of according to Federal, State, or local regulations? (circle) **Yes** No N/A If yes, proceed to next question. If no, describe deficiency and what is being done to resolve it:
43. Does this range participate in or have a HW Management Plan (HWMP)? (circle) **Yes** No N/A If yes, proceed to next question. If no, explain why this range does not participate in or have a HWMP:
Specifically Regulated Toxic Substances
44. Does this range have a PCB Management Plan that addresses storage, labeling, handling, and disposal practices consistent with Federal, State, and Navy requirements? (circle) **Yes** No N/A Explain:
45. Does this range have a designated Asbestos Program Manager (APM) and a current Asbestos Management Plan (AMP)? (circle) **Yes** No N/A Explain: Public works/host responsibility.
46. Have all facilities on this range been surveyed for asbestos-containing material (ACM) and the condition of ACM material? (circle) **Yes** No N/A If yes, are there any buildings/structures on this range or in range support areas that have ACM or have had ACM abated? (circle) Yes **No** N/A Explain:
47. Have all facilities on this range been surveyed for lead-based paint (LBP)? (circle) Yes No N/A If yes, are there any buildings/structures on the range or in range support areas that have LBP or have had LBP abated? (circle) Yes No N/A Explain:
48. If PCB-containing items, ACM, or LBP are removed from range equipment, utilities, or structures, are all processed according to Federal and State laws and Navy requirements for safe handling, containment, labeling, manifesting, and disposal practices? (circle) **Yes** No N/A Explain: *Some PCB equipment cannot be replaced because it is part of needed equipment that has no available replacement parts.*

Form 8. Military Munitions/Solid Waste/Hazardous Materials/Hazardous Waste Interview Record (continued)

Regulatory Impacts on Range
49. Has this range been inspected by an agency that regulates HM or HW within the past 5 years? (circle) **Yes** No N/A If yes, state name of agency or agencies and any deficiencies noted in most recent inspection report(s): VDEQ inspected NSWC DL on February 24 and March 15, 2006. Alleged violations have been resolved by corrective actions as indicated by letter from 11 September 2006 letter from VDEQ. Facility had not determined if vacuum filters in dental clinic were hazardous waste – facility will treat as HW (resolved). A COD vial was not labeled, but was labeled during inspection (resolved). Seven 55-gallon drums containing lead-contaminated HEPA filters from gun range were not labeled, but labels were applied during inspection (resolved). Problem noted with asbestos abatement contractor not certified to transport asbestos-laden filters offsite. They were brought back to site. Crushing boxes may have released asbestos on ground.
50. Have Federal, State, or local HM or HW regulators issued this range any Notice of Violation (NOV)? (circle) Yes **No** N/A If no, proceed to next question. If yes, who issued the NOV, what was the NOV for, and how are deficiencies being resolved?
51. Are there additional applicable HM or HW regulations that have not yet been addressed during this interview? (circle) Yes **No** If yes, list applicable regulations and administering agency: Is there a conditional exemption for the storage of WMM off range? (circle) Yes No
52. Have any Federal, State, or local HM or HW regulations negatively impacted range operations? (circle) Yes **No** If yes, state the regulation(s) and negative impacts:
53. Are there plans to change the frequency or type of range operations in such a way that would impact the quantity of wastes generated from this range? (circle) Yes **No** If no, go to next question. If yes, what types of wastes do you expect to increase or decrease as a result of changes in range operations?
Off-Range Release
54. Has the Navy, regulatory agency, or public expressed any concerns about fired munitions landing off range or the off-range migration of residual MCs of potential concern and their impact on surrounding communities or environment? (circle) **Yes** No Explain: *Some members of the public frequently complain about vibration and noise from range activities and occasionally inquire about potential constituents from range testing operations.*
55. Have any off-range releases of munitions or their constituents occurred that have negatively impacted the surrounding community or environment? (circle) Yes No Explain: *None documented. However, the debris at the Old Plate Battery Test Range could release MCs to the Potomac River.*
Documents
56. Do you have copies, preferably electronic, of any documents that address HM or HW that impact this range including, but not limited to, a Navy Hazardous Waste Annual Report, any EPA or State program reports, copies of program management plans (e.g., HMC&M Plan, HWMP, AMP, PCB Management Plan), and inspection reports? List copies of documents obtained: See Form 3.

[1] Refer to Military Munitions Rule [Federal Register: February 12, 1997 (Volume 62, Number 29)] and DoD Policy to Implement EPA's Military Munitions Rule, 1 July 1998.

[2] HW generator: Any person, by site, act, or process produces HW or whose act first causes an HW to become subject to regulation.

HW generator classifications:

Class I = (Large Quantity Generator). Monthly generation quantity of 1,000 kilograms (kg) (2,200 pounds [lbs]) or more HW or 1 kg (2.2 lbs) or more acute HW.

Class II = (Small Quantity Generator). Monthly generation quantity of 100 – 1,000 kg (220 - 2,200 lbs) HW and less than 1 kg (2.2 lbs) acute HW.

Class III = (Conditionally Exempt Small Quantity Generator). Monthly generation quantity less than 100 kg (220 lbs) HW or less than 1 kg (2.2 lbs) of acute HW. Such generators are exempt from substantially all RCRA requirements.

(Source: OPNAVINST 5090.1B CH-4, Navy Environmental and Natural Resources Program Manual, Chapter 12, Hazardous Waste Management Ashore)

Form 9. Cultural Resources Interview Record

Point of Contact (POC) Information		
1. Date: 10/30/2006	2. Time:	3. Location: via phone and email
4. Tactical Theater Name: Not Applicable		
5. Range Complex Name: Not Applicable		5. Range Complex Name: Not Applicable
7. Name of POC Interviewed:		
8. POC Title: NSF Dahlgren NEPA & CR Program Office Manager		
9. E-mail Address:		10. Phone Number:
11. POC Navy Command Affiliation: Naval Surface Warfare Center, Dahlgren Laboratory (NSWC DL)		
12. Dept./Div./Branch: H2W		13. Contractor? (circle) Yes **No**
14. Name and Affiliation of Interviewer: SAIC, RSEPA Technical Team Members		

General Cultural Resources
15. Briefly describe the current cultural resource program at this range, if any: *AA Fuze: None* *EEA: 7 Archaeological sites within boundaries* *Machine Gun Range: None* *Main Range: Within boundaries of Historic Main Range District* *Missile Test Range: 9 Archaeological sites within boundaries* *Terminal Range: 2 Archaeological sites within boundaries*
16. Is there a current Integrated Cultural Resource Management Plan (ICRMP), Cultural Resource Management Plan (CRMP), and/or a Historic and Archaeological Resources Protection (HARP) Plan? Can you provide copies, preferably electronic, of these documents? *These plans have not been developed.*
Archaeological Resources
17. Briefly describe the number and types of known archaeological resources at this range (e.g., general time periods, preservation conditions, unique qualities). *18 known archaeological sites. All sites preserved in situ.* *All sites considered National Register Eligible.*
18. Have cultural resource surveys been conducted on the operational ranges? If so, has the entire range(s) been systematically surveyed? *Mainside Ranges: Yes* *EEA: Only a portion. Areas of explosive operations will not be done due to safety constraints.*
19. Are there known archaeological resources located on an operational range? If so, have they been evaluated for National Register of Historical Places (NRHP) eligibility? *18 known archaeological sites. All sites preserved in situ.* *All sites considered National Register Eligible.*
20. What procedures are in place to avoid, minimize, or mitigate effects of future undertakings, especially if located on an active range? *Environmental planning and the NEPA process evaluate effects on any undertakings.*
21. Where are archaeological collections and their associated records housed, and does this repository meet 36 CFR 79 (Curation of Federally Owned and Administered Archaeological Collections) requirements? *Archaeological curation area is at NSF Dahlgren, meets minimal criteria.*
Historic Built Environment
22. Are there any buildings or structures located on an operational range? If so, have they been evaluated for NRHP eligibility (including those related to the Cold War era)? *Yes buildings and structures have been evaluated on operational ranges and are not eligible for the NRHP.*
23. Are there any National Historic Landmarks or State/local designated historic sites (e.g., State Historic Landmark, State Register of Historic Places) located on an operational range? *NO*
24. What procedures are in place to avoid, minimize, or mitigate effects of future undertakings, especially if located on an active range? *Environmental planning and the NEPA process evaluate effects on any undertakings.*
Native American Consultation
25. What Federally recognized Native American/Hawaiian groups have expressed interest in cultural resource issues related to this range? *There are no know native American groups in the area expressing interest in cultural resources at NSWC DL.*
26. Are there any known tribal resources or sacred sites located on an operational range? If so, what type of Native American/Hawaiian consultation has been conducted related to these resources? *There are no know tribal resources or sacred sites on operational ranges.*
27. Has any group requested visitation rights to any known tribal resource or sacred site at this operational range? If so, has the Navy complied with these requests? *No.*
28. Has a NAGPRA-related *Summary* and *Inventory* been completed for collections related to this operational range? What are the pending repatriation issues, if any? *No collections relating to the operational range.*

Form 9. Cultural Resources Interview Record (continued)

29. What procedures are taken to consult with Native American/Hawaiian groups during NEPA and NHPA Section 106 processes? *Consultation with the SHPO for mitigation of affect during the NHPA and NEPA process involves the Virginia Council on Indians.*
30. Are Native American/Hawaiian monitors employed during archaeological surveys or excavation work? *N/A*
Regulatory Compliance
31. Who is responsible for compliance issues regarding cultural resource regulations and general management of cultural resources at this range? *Host activity: Naval Support Facility, Dahlgren - Cultural Resources Program Office.*
32. What procedures are taken to evaluate proposed actions for their potential impacts to cultural resources on an operational range? *The Environmental Analysis process is implemented as well as NEPA evaluation in the planning process.*
33. Have NEPA and NHPA Section 106 studies been conducted for the operational use of all operational ranges? How does the range implement procedures for public involvement per 36 CFR 800? *This will be done for future work under the Range EIS that is yet to be completed.*
34. What procedures are in place to comply with Section 110 of NHPA? *The Navy has a Cultural Resources Program Office at Dahlgren that implements full execution of all Federal Historical Preservation law. Section 110 involves identifying resources, which has been done through archeological and architectural surveys.*
35. Does this range have a Programmatic Agreement (PA) with SHPO? If so, are activities associated with the operational use of all active ranges covered under this PA? *A PA will possibly be established following the completion of the EIS for affects cultural resources within the operational ranges.*
36. Is this range currently in noncompliance with any Federal regulations related to cultural resources? *No*
37. Has SHPO, a Native American/Hawaiian group, or any other interested party expressed concern about either direct impacts on cultural resources from range use (e.g., bombing, tracked-vehicle use) or indirect impacts from toxic releases related to ordnance? *No*
Documents
38. Do you have copies, preferably electronic, of any documents that address cultural resource issues that impact the range including, but not limited to, an ICRMP, CRMP, HARP plan, PA, or cultural resource overviews? List all documents received: *No documents received. There is currently no ICRMP or PAs.*

Form 10. Natural Resources Interview Record

Point of Contact (POC) Information		
1. Date: 10/31/06	2. Time: 1230	3. Location: Building 189
4. Tactical Theater Name: Not applicable		
5. Range Complex Name: Not applicable		6. Range Name: Explosives Experimental Area Range, Machine Gun Range, Anti-Aircraft Fuze Range, Main Range, Terminal Range, Shock Tube Road Range, and Missile Test Range
7. Name of POC Interviewed:		
8. POC Title: Natural Resources Manager		
9. E-mail Address:		10. Phone Number:
11. POC Navy Command Affiliation: Navy District of Washington (NDW) or Naval Surface Warfare Center, Dahlgren Laboratory (NSWC DL)		
12. Dept./Div./Branch: Safety and Environmental/Natural Resources/HN2W		13. Contractor? (circle) Yes **No**
14. Name and Affiliation of Interviewer: SAIC, RSEPA Technical Team		
General Natural Resources		
15. Is there a current INRMP for this range? *Yes, the current INRMP was prepared in 2001. A revised INRMP will be completed in 2007. Is this range or range complex covered in the INRMP? (Ranges must review and update these plans every 5 years.) Yes, the INRMP includes the ranges.*		
16. Briefly describe any current natural resource programs at this range, especially if they involve any operational ranges (e.g., conservation programs, native species restoration, propagation programs). *Hunting, fishing, trapping, and timber management occur at Dahlgren.*		
Biological Resources		
17. Briefly describe any biological/habitat surveys that have been conducted on an operational range. *Various natural resources mapping and surveying efforts, including forest inventories and wetlands surveys, have been conducted. For example, a master list of vegetation and fauna for the installation was developed during surveys conducted in 1978. More recently, an ecological community survey and rare species survey were completed a few years ago. Currently, annual eagle nesting surveys are conducted by the College of William and Mary in cooperation with the Virginia Department of Game and Inland Fisheries.*		
18. Identify all sensitive species (threatened or endangered species, species of concern, State sensitive species) that are known residents or seasonal visitors on an operational range: *The Virginia Department of Conservation and Recreation, Division of Natural Heritage (VDCR-DNH) conducted a Natural Heritage Inventory at NSWCDL during 1991 and 1992. The goal of this inventory was to systematically identify all of NSWC DL's Natural Heritage Resources, which included rare plants and animals, special interest areas, and other significant natural features. Bald eagle is the only threatened and endangered species at Dahlgren. There are typically one nesting pair at the Mainside Ranges and 3 or 4 pairs at the EEA Range. Two Special Interest Areas (SIAs) totaling 810.6 acres are located on Mainside and three SIAs totaling 222.3 acres are located on Pumpkin Neck. The SIAs have unique ecological characteristics and/or high quality habitat for rare species. These SIAs are given special consideration during land use planning.*		
19. Is there any designated critical habitat located on an operational range? *No habitat on the ranges has been designated critical habitat, including any wetlands present on the ranges.* Is there any known potentially suitable unoccupied habitat present for a threatened or endangered species, even if not officially designated as critical habitat? No		
20. What procedures are in place to protect species from disturbance, especially if located on an operational range? Do these procedures include periodic monitoring? *No disturbances are allowed near bald eagle nests from December 15 to June 15. Dahlgren is currently having a contractor complete a Draft Bald Eagle Management Plan. NSWC DL also establishes bald eagle protection zones during the nesting season in accordance with the Bald Eagle Protection Guidelines for Virginia (USFWS and VDGIF, 2001). All management activities within these zones are primarily designed to improve habitat for this species and timed accordingly to avoid disturbance of nesting eagles. Please see #17 for discussion on bald eagle monitoring.*		
21. What is the status of USFWS/NMFS consultation regarding the operational use of all operational ranges? Have any Biological Opinions (BOs) been issued by USFWS/NMFS? *The USFWS reviewed the INRMP. No biological assessments were required, and no BOs have been issued by USFWS/NMFS. Currently, USFWS and Dahlgren coordinate on bald eagle issues.*		
Other Resource Areas		
22. Have all potential wetland areas at the operational range been formally delineated? Are there any jurisdictional wetlands, natural springs, riparian areas, wet areas, vernal pools, or areas of sensitive resources on an active range? If so, what procedures are in place regarding wetland protection? *Wetland communities encompass approximately 16% of the installation. The Navy considers wetland protection a top priority as reflected by their "No Net Loss" wetland policy. The wetland protection policy of NSWC DL is in strict compliance with federal and state requirements and the Navy's wetland policy. All proposed development activities are coordinated with the Natural Resources Manager early in the planning process to ensure that wetland issues are addressed. In addition, project-specific wetland delineations are conducted in accordance with the Corps of Engineers Wetlands Delineation Manual on an as needed basis for all proposed activities that could potentially require a Section 404 permit.*		

Form 10. Natural Resources Interview Record (continued)

23. Are the operational range(s) located in a designated floodplain? If so, what procedures are in place regarding floodplain management? *Approximately 700 acres of NSWC DL along the shores of the Potomac River, Upper Machodoc Creek, and Gambo Creek lie within the 100-year floodplain. Shore and wetland areas associated with the Potomac River, Upper Machodoc Creek, Gambo Creek, and unnamed tributaries to these waterways are mapped as a Chesapeake Bay Resource Protection Area (RPA) by the Commonwealth of Virginia. Both EEA and the Mainside ranges have areas that are within the 100-year floodplain. EO 11988 (Floodplain Management) is an applicable regulation for the NSWC DL for floodplain management.*
24. Are you aware of any other pertinent natural resource issues applicable to this operational range (e.g., migratory birds, anadromous fish, noxious weeds, wild or scenic rivers, designated wilderness)? *No. There are no other pertinent natural resource issues applicable to the ranges at Dahlgren. However, there are seven invasive plant species that are considered the most common nuisance species at NSWC DL [Common reed (*Phragmites australis*), Japanese knotweed (*Polygonum cuspidatum*), Autumn olive (*Elaeagnus umbellata*), Tree of heaven (*Ailanthus altissima*), Bush clover (*Lespedeza serica*), Multiflora rose (*Rosa multiflora*), and Japanese honey suckle (*Lonicera japonica*)]. Common reed is the most prevalent invasive species at NSWCDL and is treated with herbicides. Also, anadromous species such as striped bass, hickory shad, American shad, blueback herring, alewife, and white perch use the Potomac.*
Compliance
25. Who is responsible for compliance issues regarding natural resource regulations and general management of natural resources at this operational range? *Dr. Wray, Natural Resources Manager for NSWC DL*
26. What procedures are taken to evaluate actions for the potential impact on natural resources, especially those planned on operational ranges? *All new actions are reviewed by Dr. Wray, who assesses the potential for adverse impacts on natural resources.*
27. Is this operational range currently in noncompliance with any Federal regulations related to natural resources? No
28. Has any outside party (including nongovernment organizations) threatened or instigated legal action against the Navy with regard to natural resources at this operational range? No
29. Has the USFWS/NMFS, an environmental group, or any other interested party expressed concern about direct impacts on natural resources from range use (e.g., bombing, tracked-vehicle use) or indirect impacts from toxic releases related to munitions? No
Documents
30. Do you have copies, preferably electronic, of any documents that address natural resource issues that impact the range including, but not limited to, the INRMP, BOs, Biological Assessments (BAs), Environmental Assessments (EAs), Environmental Impact Statements (EISs), survey reports, and wetland delineation reports? List all documents received: *Natural Resource Management Office, Naval Surface Warfare Center, Dahlgren Site, Dahlgren, VA. 2001. Integrated Natural Resources Management Plan, Naval Surface Warfare Center, Dahlgren Site. 2001. Final October 2001.*

Form 11. EPCRA Interview Record

Point of Contact (POC) Information		
1. Date: 30 October 2006	2. Time: 1:30	3. Location: Building 189, Room 119
4. Tactical Theater Name: Not Applicable		
5. Range Complex Name: Not Applicable		6. Range Names: Explosives Experimental Area Range, Machine Gun Range, Anti-Aircraft Fuze Range, Main Range, Terminal Range, Shock Tube Road Range, and Missile Test Range
7. Name of POC Interviewed: Environmental Protection Specialist for host command Naval District Washington (NDW); Environmental Programs Manager Naval Surface Warfare Center, Dahlgren Laboratory (NSWC DL)		
8. POC Title: Environmental Protection Specialist		
9. E-mail Address:		10. Phone Number:
11. POC Navy Command Affiliation: Naval Surface Warfare Center, Dahlgren Laboratory		
12. Dept./Div./Branch: Safety and Environmental (HN2W)		13. Contractor? (circle) Yes **No**
14. Name and Affiliation of Interviewer: SAIC, RSEPA Technical Team Members		

Section 313 Reporting on Munitions Activities[1]
15. What operational range areas are being evaluated for EPCRA TRI applicability? *Two areas are evaluated for EPCRA TRI applicability: The Dahlgren Mainside (which includes Main Range, Terminal Range, Shock Tube Road Range, Anti-Aircraft Fuze Range, Machine Gun Range, and Missile Test Range) and EEA (Pumpkin Neck) (which includes the Harris and Churchill Ranges).* *As per EPCRA requirements, all test and evaluation activities, laboratory activities, lead abatement, and vehicle maintenance activities are exempt from reporting activities. All military training activities, such as the use of the small arms military range to train security force personnel within the Machine Gun Range, are applicable for EPCRA TRI reporting. In addition, the OB/OD operations at EEA (Pumpkin Neck) are treatment activities and applicable for EPCRA TRI reporting.*
16. Do operational range areas have 10 or more full-time employees[2] (or 20,000 manhours/yr)? (circle) **Yes** No If yes, proceed to next question. If no, Navy is exempt from reporting under EPCRA Section 313 for munitions. Determine if Navy has documented employee man-hour exemption.
17. Were activities performed at operational range areas involving munitions during the calendar year? (circle) **Yes** No N/A If yes, proceed to next question. If no, reporting is not required under EPCRA Section 313 for munitions. Determine if Navy has documented exemption.
18. What types of munitions-related activities were evaluated for toxic chemical threshold determination for the past calendar year? *For the Mainside ranges, military training activities have been evaluated for the toxic chemical threshold determination. An inventory of materials used for activities within the Mainside is maintained by the Hazardous Materials Management Software (HSMS). The quantities of EPCRA constituents released by activities such as the training of security force personnel is calculated based on the consumption of materials.* *For EEA (Pumpkin Neck) exploding, open burning, and open detonation of munitions were evaluated for the toxic chemical threshold determination. The quantities of chemicals generated by munition activities at the EEA (Pumpkin Neck) are calculated by maintaining a database of the munitions expended and utilizing the Toxic Release Inventory – Data Delivery System (DDS) to calculate the constituents released through the use of the munitions.*
19. List all toxic chemicals that met threshold quantities and indicate if any are persistent, bioaccumulative, and toxic (PBT): No toxic chemicals met threshold quantities for Mainside ranges. *Lead, which is a PBT, is the only toxic chemical that met threshold reporting quantities for EEA (Pumpkin Neck).* *In the past (before 2004, when Ms. Morgan became involved in the EPCRA reporting), quantities of mercury, which is also a PBT chemical, have also been monitored for EPCRA TRI reporting.*
20. Was a Form R submitted for TRI reporting? (circle) **Yes*** No N/A If yes, proceed to next question. If no, explain: **A form R was submitted for EEA (Pumpkin Neck). Because the quantities of toxic chemicals did not meet threshold reporting requirements for the Mainside, no form was submitted for this area.*
21. Have Section 313 reporting deadlines been met for munitions-related activities? (circle) **Yes** No If yes, proceed to next question. If no, explain:
EPCRA Reporting on Nonmunitions (Installation) Activities
22. Was a Form R submitted for TRI reporting for nonmunitions activities? (circle) Yes **No** If yes, proceed to next question. If no, explain: *No threshold quantities were exceeded for nonmunitions activities. To monitor nonmunition (installation) activities and determine threshold status, Hazardous Materials Management Software (HSMS) is used to track the consumption and use of all hazardous materials. This software tracks the consumption of EPCRA TRI chemicals as well.*

Form 11. EPCRA Interview Record (Continued)

23. List all toxic chemicals that met threshold quantities and indicate if any were PBT: *N/A – no nonmunitions threshold quantities were exceeded*
24. Have reporting deadlines been met for all operational ranges EPCRA reporting (including emergency release notifications and Sections 311, 312, and 313 reporting)? (circle) **Yes** No Explain:
Regulatory Impacts on Range
25. Have Federal or State regulators issued this range any NOVs for EPCRA noncompliance? (circle) Yes **No** If no, proceed to next question. If yes, who issued the NOV, what were the deficiencies, and how are the deficiencies being resolved?
26. Have any EPCRA compliance requirements from DoD, Navy, or a regulatory agency negatively impacted range operations? (circle) Yes **No** N/A If yes, state the requirements and negative impacts.
27. Are there plans to change the frequency or type of range operations in such a way that would impact the quantity of toxic chemicals released from munitions activities? (circle) Yes **No*** If no, go to next question. If yes, what toxic chemicals do you expect to see an increase or decrease in release as a result of changes in range operations? *Although there are no plans to change the range activities, regulatory guidance may change in the future so that ranges on both the Mainside and Pumpkin neck will be combined for EPCRA reporting purposes. If this occurs, because the Pumpkin Neck is likely to exceed the lead reporting thresholds, the level of effort to complete EPCRA reporting to include all EPCRA constituents for all of the ranges will be increased significantly. Currently, the Mainside does not report EPCRA chemicals as there are no exceedances of EPCRA chemicals from Mainside use.*
Off-Range Release
28. Is there a concern by the Navy, regulatory agency, and/or public, regarding the off-range release of toxic chemicals and their possible impact on sensitive receptors off range? (circle) Yes **No,** *Frequent monitoring occurs regarding off-range releases of toxic chemicals and their possible impacts on sensitive receptors off-range (Morgan). Although perchlorate compounds are not listed in the compounds covered by EPCRA, perchlorate is a potential concern of the Navy for off-range release of chemicals (Lovejoy). Perchlorate was detected in the groundwater near the open burning and open detonation areas of Pumpkin Neck and is being closely monitored by the Navy to determine the potential for an off-range release as required by the Resource Conservation and Recovery Act (RCRA) Permit (EPA ID No. VA7170024684) for the Thermal Treatment of Hazardous Waste by Open Burning and Open Detonation.*
Documents
29. Do you have copies, preferably electronic, of any EPCRA-related documents that pertain to this range including, but not limited to, Section 313 Form R, documented toxic chemical threshold determinations, and NOVs and letters from regulatory agencies pertaining to EPCRA munitions reporting. List all documents received: • Tier II 2005 Report • Section 313 Form R (2005 Reporting Year)

[1] "Munitions activities that may involve some toxic chemicals include (but are not limited to): manufacture and assembly; chemical manufacture; load and pack; maintenance of munitions; painting and component replacement; proficiency and qualification training; live fire; propellant bag burning at firing ranges; aerial bombing; obscurant and smoke training; demolition training; testing of munitions, weapons systems, and components (most are exempt); demilitarization: disassembly, recovery, reclamation, resale, or recycle; disposal: open burning (OB) of propellant for destruction; open detonation (OD); incineration; chemical neutralization; detonation and destruction of UXO; and waste treatment activities such as chemical neutralization of pink water and other wastes." (Source: EPCRA Munitions Reporting Handbook for the U.S. Army, May 2002).

[2] "Range employees are persons who spend time on the range and whose responsibilities include operating, managing, or maintaining the range. Examples of such employees are target construction and maintenance crews, contractors or military personnel who perform range clearance sweeps or cleanup activities, natural resources managers, range control officers, and range safety officers. Civilian and military personnel using a range to conduct training exercises or testing activities do not count as range employees." (Source: DoD Final Range Policy Guidance, March 2000).

Form 12. Environmental Planning Interview Record

Point of Contact (POC) Information

1. Date: 1 November 2006	2. Time: 11:00 am	3. Location: Building 189, 1st floor conference room

4. Tactical Theater Name: Not Applicable

5. Range Complex Name: Not Applicable	6. Range Name: Explosives Experimental Area Range (EEA), Machine Gun Range, Anti-Aircraft Fuse Range, Terminal Range, Missile Test Range

7. Name of POC Interviewed:

8. POC Title:

9. E-mail Address:	10. Phone Number:

11. POC Navy Command Affiliation: Naval Surface Warfare Center, Dahlgren Laboratory (NSWC DL)

12. Dept./Div./Branch: Safety and Environmental G604	13. Contractor? (circle) Yes **No**

14. Name and Affiliation of Interviewer: SAIC, RSEPA Technical Team Members

National Environmental Policy Act (NEPA)

13. Have the environmental impacts from operations at this range been addressed in an CATEX, EA, or EIS? (circle) Yes **No**

If no, explain: *Range operations have not changed since the inception of the NSWC DL in the 1950s; therefore, these activities were "grandfathered" under the NEPA program when it was established in 1968.*

Some individual operations have been addressed such as:

the Restraint Rocket Motor Firings, which received a CATEX approximately 2 years ago;

the Electromagnetic railgun facility was addressed in an EA;

portions of the facility and/or operations that were re-aligned in the BRAC process were covered under and EA following each round of BRAC;

All range activities, water and land, will be included under the new EIS being developed.

If yes, give CATEX, EA, or EIS title and, if applicable, date of Record of Decision (ROD):

Is EIS current? (circle) Yes No

Does this CATEX, EA, or EIS cover all operations at the range? (circle) Yes No

If no, explain:

14. Are individual range operations covered by EAs? (circle) Yes **No**

If no, are range operations incorporated under an EIS? *Future range operations, including Laser operations, Electromagnetic testing, projectile testing, chemical and biological simulants, and RF are included in a EIS that is currently being developed, and should be complete within 2 to 2 ½ years.*

15. Did mitigation measures result from existing NEPA documentation? (circle) Yes **No**

If yes, are mitigation measures being adhered to? (circle) Yes No

Explain:

16. Have NEPA compliance requirements from DoD, Navy, or a regulatory agency negatively impacted range operations? (circle) Yes No

If yes, state the requirements and negative impacts:

17. Does this range have a process for reviewing new or modified range operations for compliance with existing NEPA documentation? (circle) **Yes** No

Explain: *In addition to the EIS mentioned above, any operations that require new buildings go through Facilities department for planning and design, which initiates the NPEA process for environmental review. Energetics projects, laser projects, or radiation projects must also follow an SOP with established criteria for when a formal environmental review is required.*

18. Are there plans to change the frequency or type of range operations in such a way that additional NEPA documentation would be required? (circle) **Yes** No

If no, go to next question. If yes, describe: *See 14 above.*

19. Has any outside party threatened or instigated legal action or waged a negative media campaign against the Navy with regard to NEPA compliance at this range? (circle) Yes **No**

Explain: *The complaints are strictly associated with the water range, which is not covered in this RCA.*

20. Would you consider this range to be in compliance with NEPA? (circle) **Yes** No

Explain:

21. What were the issues of concern expressed during public hearings (required by the NEPA process)? *N/A*

Land Use

22. Has an AICUZ or RAICUZ study been performed on this range? (circle) Yes **No**
If yes, when?

If no, proceed to question 23.

23. Did either study identify any Accident Potential Zone (APZ) or noise level problem areas outside the fence line? (circle) Yes **No**
If no, proceed to next question. If yes, explain problem areas and how they are being addressed:

It should be noted that no noise level problems have been identified by studies, because no noise studies have been conducted.

Form 12. Environmental Planning Interview Record (continued)

24. Does the Navy range owner work with city/county planning departments to promote land use planning that is compatible with range operations? (circle) **Yes** No Explain: *NSWC DL works with the Public Working Information Group (PWIG) which is comprised of representatives from the 6 surrounding counties.*
25. Are there any conflicts between local community-desired land use and range operations? (circle) Yes **No** Explain: *Not with land use.*
26. Is encroachment by residential and commercial development impinging upon range operations? (circle) Yes **No** Explain: *NSWC DL Public Affairs tries to work with local realtors to ensure that new residents are aware of the noise generated by firings during the week, that may not be experienced on weekends.*
27. Does the range have a program or procedures in place to address public safety concerns, noise complaints and any other public concerns related to range operations? (circle) **Yes** No Explain: *Public Affairs Office (PAO) handles complaints related to range operations and channels information to the appropriate departments.*
28. Have measures been taken to mitigate the impact of noise on surrounding communities? (circle) Yes **No** Explain: *There are 5 noise sensors used to measure actual noise on the range, and SIPS is used as a prediction model to make informed determinations as to whether firing should occur, based on local weather conditions and the predicted decibel level. There are also three noise profiles used to predict the noise levels at the muzzle, during flight, and impact.*
29. Is noise a risk to sustained range operations due to public complaints? (circle) Yes **No** Explain: *At the current time, noise does not appear to be a risk for sustained operation of the land ranges; however, future development in the surrounding area could change the risk.*
30. Have any existing NEPA documents determined that noise from this range's operations has a significant impact on surrounding wildlife? (circle) Yes **No** Explain:
Off-Range Release
31. Does the Navy, regulatory agency, or public have any concerns with regard to the off-range release of chemicals, past or present, that could limit land use, now or in the future? (circle) Yes **No** Explain: *Not from the land range.*
32. Have any off-range releases of munitions or their constituents occurred that have negatively impacted the surrounding community or environment? (circle) Yes **No** Explain:
Documents
33. Do you have copies, preferably electronic, of any documents that include, but are not limited to, CATEXs, EAs, EISs, AICUZ/RAICUZ studies/models, maps, noise mitigation measures/plans, letters from regulatory agencies pertaining to the range and environmental planning?

Form 13. Range Environmental and Explosives Safety Management Interview Record

Point of Contact (POC) Information		
1. Date: October 31 and November 1, 2006	2. Time: See #7	3. Location: Building 189, 1st Floor Conference Room unless stated otherwise
4. Tactical Theater Name: Not applicable		
5. Range Complex Name: Not applicable		6. Range Name: Explosive Experimental Area (Pumpkin Neck) Ranges: Harris Range and Churchill Range and Mainside ranges: Main Range (land based portion), Terminal Range, Shock Tube Road Range, Anti-Aircraft (AA) Fuze Range, Machine Gun Range, Missile Test Range
7. Name of POC Interviewed:		
8. POC Title: Explosive Experimental Area (G64) Ammunition Support (G61) Range Safety Director (G604) Range Control (G61)		
9. E-mail Address: Not provided		10. Phone Number: Not provided
11. POC Navy Command Affiliation: See #8		
12. Dept./Div./Branch: See #8		13. Contractor? (circle) **Yes** **No (see #8)**
14. Name and Affiliation of Interviewer: SAIC, RSEPA Technical Team Members		

Administrative Requirements

15. Does this range have a management plan[1] addressing the requirements of DoD Directive 4715.11 that includes long-term sustainable range management objectives? (circle) Yes **No** Explain:

The following document includes many elements required by DoD Directive 4715.11, but it is not a range management plan: Dahlgren Site Ordnance Safety and Operational Procedures, NAVSWCINST 8000.1, Naval Surface Warfare Weapons Center (NSWC), Dahlgren, Virginia 22448, Silver Spring, Maryland 20910. 17 June 1983.

16. Does this range keep permanent records of munitions expended, including dud rate, by type quantity, location, and using organization? (circle) **Yes** No Explain:

NSWC DL has an extensive process for planning, conducting, and documenting all tests that have been conducted dating back several decades. The results are recorded in ledgers that are maintained by the Engineering Branch (G61). These records include munition expenditures, dud rates, munition types, quantities, locations, and using organizations.

17. Does this range keep permanent records of all UXO clearance operations and EOD incidents on range? (circle) **Yes** No Explain:

UXO clearance operations have been conducted and documented for Installation Restoration (IR) projects and are documented in IR reports.

18. Has this range conducted UXO surveys that are kept current? (circle) **Yes** No Explain:

On Mainside, UXO is removed during the refurbishment of plate targets and target butts. In addition, surveys have been conducted as an adjunct to installation restoration projects. At EEA, munition debris is recovered after tests and handled in accordance with Navy ORC Policy.

Explosives Safety Management

19. Is range access restricted? (circle) **Yes** No If yes, by what means:

On the land side of Mainside and EEA, a fence prohibits entrance on to Navy property. Mainside includes 2 guarded gates. EEA includes a gate with camera and remote entry. In the water, multiple cameras are used and security forces patrol the riverways on the river/creek boundaries of the ranges.

20. Do individuals who are authorized access to this range receive explosives safety training before entering the range? (circle) **Yes** No Explain: *NAVSWCINST 8000.1 requires training for all personnel who handle explosives.*

21. Is there a procedure in place to determine when individuals who are authorized access to this range will be escorted? (circle) **Yes** No Explain: *NAVSWCINST 8000.1 requires all visitors to be escorted. Access to facility is controlled, so entrance is not possible without escort.*

Form 13. Range Environmental and Explosives Safety Management Interview Record (continued)

22. Are sole use target/impact areas designated to segregate munitions use? (circle) **Yes** No Explain: *Plates, concrete blocks, and target butts are used for projectiles.*
23. Are submunitions and depleted uranium use restricted to specifically designated areas? (circle) **Yes** No Explain: *Submunitions are no longer used, but even when they were, the areas where they were used is limited and known. All areas where DU was used have been decommissioned and closed in accordance with NRC requirements.*
24. Has this range established procedures for range clearance operations, including clearance frequency and degree? (circle) **Yes** No Explain: *Clearance is not needed in Potomac River Test Range where many munitions are fired. Range clearance is conducted during refurbishment of plate targets. At EEA, munition debris is recovered after most operations.*
25. Is a hazard assessment conducted before any range clearance operations are conducted? (circle) **Yes** No Explain: *Hazard assessments are documented in the Test Plan that are required for all tests. Several individuals including EOD and safety must approve test plans before tests can be conducted.*
26. Does this range conduct appropriate range clearance operations prior to changing the use of a range area? (circle) Yes No Explain: *The only cases where this has been needed has been for munition removals incidental to IR projects.*
27. Has this range established safe and practical methods[2] for recycling and disposing of range residues[3], such that range residues do not contain ammunition, explosives, or other dangerous articles prior to public release? (circle) Yes No Explain: *The range stores all inspected munition debris in a secure location. It is then disposed of in accordance with Navy ORC requirements.*
28. Does this range have an established procedure for responding promptly to protect personnel and property from explosives hazards on and off range? (circle) Yes No Explain: *EOD participates in tests with live munitions and would respond immediately to munitions that land off range. However, during the interview process, it was stated that no munitions have landed off range in many years.*
Range Environmental Management
29. Is a program or procedure in place to assess the environmental impacts of munitions use on this range? (circle) **Yes** No Explain: *Range operations personnel coordinate with environmental staff. In addition, environmental staff inspect ammunition storage magazines, so they are aware of munition expenditures.*
30. Does this range use targets that do not contain hazardous materials, such as petroleum, lubricants, radium dials, and batteries? (circle) ***Yes*** No Explain: *The only targets used at NSWC DL include steel plates, earthen berms, and concrete blocks.*
31. Describe the use of controlled burning[4] on this range: *Not applicable*
Range Explosives Safety Communication
32. Does this range provide appropriate information to local officials regarding compatible use of land surrounding the range? (circle) **Yes** No Explain: *NSWC DL has an extensive public outreach program including a website with range schedules and phone numbers for surrounding populations to contact the test center. In addition, security personnel patrol the Potomac River and Upper Machodoc Creek during tests.*
33. Does this range have an established procedure for notifying Range Management personnel and the public of off-range explosives hazards? (circle) **Yes** No Explain: *Website and phone number.*
34. Does this range participate in a public-involvement program that provides a forum for the Navy and the public to discuss explosives hazards and other range issues that affect or have the potential to affect surrounding communities? (circle) **Yes** No Explain: *The Commanding Officer has attended public meetings to discuss the importance of Dahlgren's mission to the national defense.*
35. Does this range have a Public Outreach Plan? (circle) **Yes** No Explain: *Community Involvement Plan for the Integrated Management Plan Environmental Impact Statement, Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia. June 2004.*
36. Does this range have a program in place to educate DoD personnel, their dependents, and private citizens living near this range on explosives hazards? (circle) Yes **No** Explain: There was no indication that such a program exists.
Off Range Release
37. Does this range have a procedure in place for responding to a release or substantial threat of release of MCs of potential concern off range, when such a release poses an imminent and substantial threat to human health or the environment? (circle) Yes **No** Explain: *Although NSWC DL has a successful and mature IR program, there does not appear to be a mechanism to address the hazards at the Old Plate Battery Test Range.*

Form 13. Range Environmental and Explosives Safety Management Interview Record (continued)

Documents
38. Do you have copies, preferably electronic, of any documents that pertain to this range including, but not limited to, a Range Management Plan, an Operations Management Plan, a Range Safety Plan, a range clearance policy, a Range Public Outreach Plan, AICUZ/RAICUZ study/maps, a munitions off-range release response plan, environmental assessments of munitions affect on range environment, munitions records, Range Maintenance Plans, and UXO survey?
List all documents obtained: See Forms 3 and 5.

Release – Munitions or MCs of potential concern that escape into the environment beyond the defined range boundary.

[1]Section 5.4.4 specifies that plans, at a minimum, will address long-term sustainable use, management procedures, recordkeeping, standards, monitoring, public outreach, public participation programs (if required), technology requirements to ensure sustainable range management, integration with other range planning processes, and resources.

[2]In accordance with DoD Manual 4160.M (reference f).

[3]Examples of range residues include cartridge cases, ordnance-derived wastes, and targets.

[4]Per DoD Directive 4715.11, Section 5.5.8, controlled burning of vegetation as a method of UXO clearance is prohibited. Controlled burning may be used to control dense brush and undergrowth to make UXO clearance operations safe for personnel conducting clearance.

Form 14. Installation Restoration Interview Record

Point of Contact (POC) Information		
1. Date: 10/31/06	2. Time: 0830	3. Location: Dahlgren Bldg 189 Room 203
4. Tactical Theater Name: Not applicable		
5. Range Complex Name: Not applicable		6. Range Name: Main Side, Explosives Experimental Area
7. Name of POC Interviewed:		
8. POC Title: Installation Restoration Manager		
9. E-mail Address:		10. Phone Number:
11. POC Navy Command Affiliation: Navy District of Washington (NDW)		
12. Dept./Div./Branch: Safety And Environmental		13. Contractor? (circle) Yes **No**
14. Name and Affiliation of Interviewer: SAIC		

Release & CERCLA[1]

15. Has a release[1] of hazardous substances[2], pollutants[3], contaminants, or petroleum-based products occurred **on range**? (circle) **Yes** No

If yes, describe releases (number of sites, locations on range, chemicals, and quantities) and whether and to whom releases were reported: The installation has worked with VDEQ and USEPA to aggressively investigate, remediate, monitor, and/or bring to closure 94% of the identified IR site areas and SWMUS and is seeking to be de-listed from Superfund by 2010. The status of IR sites on active test ranges shown below:

IR Site	IR Site #	Range	Status
Old Bombing Range	1	Missile Test	On active range
Fenced Ordnance Burial Area	2	Missile Test	ROD, LTM
Projectile Disposal Area	5	Terminal	On active range
Hideaway Pond	10	Missile Test	ROD, LTM
Pesticide Rinse Area	25	AA Fuze	ROD-RA
Airplane Park Dump	31	EEA	ROD-NFA
Fast Cook-Off Pit and Pond	32	EEA	ROD-NFA
Otto Fuel Spill	33	EEA	Not Sampled
Depleted Uranium Mound	36	EEA	ROD-NFA
Lead Contamination Area	37	SC/MG	ROD-RA pending
Open Storage Area Main Battery	39	Main	CLOSED
Higley Road Land Application Area	43	Missile Test	RA, DD-NFA
Landfill A: Stump Dump Road	46	Missile Test	ROD-RA
WWI Munitions Mound	47a	Missile Test	RA completed
EOD Scrap Area	47b	Missile Test	RA completed
Depleted Uranium Gun Butt	49	SC/MG	ROD-NFA
Octagon Pad Dump	59	EEA	CLOSED
Gambo Creek Projectile Area	61b	Terminal	CLOSED
Building 396	62	Terminal	ROD-RA

Main Side still contains unresolved ordnance–related contamination associated with historical (WWII era) air-ground bombing. Ordnance-related contamination not typically addressed under IR program except where incidentally encountered during investigations. As a result ordnance-related contamination is not comprehensively addressed under IR program. Potential exists for release of munitions constituents from ordnance site areas located on range or off range. Of particular interest with respect to unresolved munitions are IR Site 1 (Old Bombing Range) comprising roughly half of the active Missile Test Range and IR Site 5 (Projectile Disposal Area) on the Terminal Range. There are no documented releases associated with these sites at this time.

Explosives releases to groundwater have been reported from Site 2- Fenced Ordnance Burial Area located at the western boundary of the Missile Test Range. The burial area was used to dispose of excess munitions. Concentrations of 1,3-DNB (0.19 u/L), 2-NT (1.1 ug/L), 4-NT (3.5 ug/L), HMX (1.9 ug/L), and RDX (0.2 ug/L) reported in October 2005. The site area has undergone a removal action and is currently in long term monitoring. Site 2 is located immediately north of Gambo Creek.

Hideaway Pond (IR Site 10) is a man-made surface water body on the Missile Test Range used for recreational purposes that contains mercury-contaminated sediment and fish. The site is approximately 1,250 feet from the Potomac River. Site 10 is undergoing long term monitoring. The site is located in a marshy portion of the Gambo Creek drainage area. Environmental releases from the site area will occur to the Gambo Creek drainage or directly to the Potomac River Range.

Form 14. Installation Restoration Interview Record (continued)

Historical releases from range-adjacent site areas including IR Site 16 (1.2 Mgal JP-2 tank) and IR Site 12 (Chemical Burn Area) indicate potential for unresolved fuel (Site 16) or VOC, MEC (Site 12) releases to groundwater. Site 12 is currently undergoing air sparging/soil vapor extraction remediation. Site 16 was remediated by removing the tank and contaminated soil, however, the period of tank losses prior to remediation is unknown. VOCs detected in Site 12 groundwater consist of 1,1,2,2-TCA 2 ug/L), 1,1-DCA (1 to 11,000 ug/L), 1,1-DCA (1 to 6,200 ug/L), 1,1,1-TCA (1-100,000 ug/L)toluene (1 to 1,700 ug/L). MEC in groundwater consisted of RDX (1.2 to 4.7 ug/L). Sites 12 and 16 are located in the Gambo Creek drainage area. Environmental releases from the sites would be transported via Gambo Creek to the Potomac River Range.

Munitions were identified during RA pre-design at Site 37 (Small Caliber/Machine Gun Range). The site consists of gun butt sand deposited on the shoreline area. Excavation plan will require more extensive safety-arc setback which will impact nearby admin offices, housing, critical research and development operations, and navigable waterways for extended periods of time. Although, multimedia environmental sampling did not indicate a release of MECs based on 1996-2001 analyses, the potential presence of MECs is very high including 40-mm anti-personnel munitions from range activities extending offshore. Any release of MCs from the Small Caliber/Machine Gun Range will be to the Potomac River Range.

Release of ordnance-related debris to beach area on eastern shore of Missile Test Range is documented by the facility and was observed during site tour. Site area has been designated as Old Battery Plate Munitions Area. The debris source is a land based burial that is undergoing exposure on the shoreline through bluff erosion. EOD personnel routinely sweep beach area for ordnance following storm events and remove ordnance pieces. Iron oxides (and possibly other metals or munitions constituents) are leaching from the debris components and precipitating on the shore. IR department encountered munitions during incidental trenching associated with adjacent IR site area 47B and estimates that the burial may encompass approximately 2 acres inland extending into the Potomac River Range.

Groundwater from the shallow Columbia aquifer underlying Main Side post area is likely impacted by range and off range activities. The aquifer is not used as potable water source on post and is segregated from drinking water aquifer. However, shallow groundwater from Columbia discharges to marsh areas largely associated with Gambo Creek drainage and surface water streams including the Potomac River. Groundwater assessments conducted on a site by site basis at Dahlgren do not provide a comprehensive assessment of on-range groundwater quality but indicate potential for environmental release. Groundwater monitoring wells are well positioned on the perimeter of Main Side and EEA to detect mission-related releases to groundwater at the installation boundaries with the exception of the active test ranges on the eastern boundary of Main Side.

Limited sampling and analysis has been conducted to assess perchlorate concentrations in groundwater at several range and range-adjacent sites.
Dahlgren has voluntarily tested for perchlorate in surface water, groundwater, soil, and sediment to determine if there have been any releases to the environment from site activities. Sampling for perchlorate began in 2001 and continues today at Dahlgren (DoD MERIT Perchlorate Work Group.)

***Groundwater** – The Navy has tested 220 groundwater samples from 12 sites for perchlorate. 120 of these samples had perchlorate detections. The average detection was 118.2 ppb. The highest detection was 2,700 ppb.*
***Surface Water** – The Navy has tested 19 surface water samples from 6 sites for perchlorate. Three of these samples detected perchlorate. The average detection level was 12.7 ppb. The highest detection level was 230 ppb.*
***Soil** – The Navy tested 111 soil samples from 7 sites where perchlorate releases might have occurred due to site activities. Of these samples, there were 9 samples with perchlorate detections. The average detection being 21.4 ppb and the highest detection was 1,200 ppb.*
***Sediment** – The Navy tested 25 sediment samples from 6 sites for perchlorate. There was one perchlorate detection of 120 ppb.*

Dahgren holds a Resource Conservation and Recovery Act (RCRA) Part B Permit for the Thermal Treatment of Hazardous waste by Open Burning and Open Detonation (OB/OD) issued by the Virginia Department of Environmental Quality (VDEQ). Perchlorate has been found in the groundwater in the vicinity of the OB/OD units. Dahlgren and the VDEQ are working together to address this issue (DOD MERIT Perchlorate Work Group). Information provided by Dahlgren during the course of the ECP investigation identified the following site data:

Form 14. Installation Restoration Interview Record (continued)

IR Site	Site Name	SWMU Site	PERCHLORATE	Area Size (acres)	Status
IR SITE 002	FENCED ORDNANCE BURIAL AREA	OLD SWMU 046	0.24 to 0.49 µg/L	4.7036	ROD-RA comp; LTM
IR SITE 003	ORDNANCE BURN STRUCTURE	OLD SWMU 042	Not Detected	0.0206	NFA
IR SITE 004	CASE STORAGE AREA		5 µg/L	2.5425	SSP;EE/CA; Removal underway
IR SITE 009	DISPOSAL/BURN AREA	OLD SWMU 019	Not Detected	7.9122	ROD; LTM; Wetland monitoring
IR SITE 012	CHEMICAL BURN PIT	OLD SWMU 044	Not Detected	0.1771	AROD underway; RA completed
IR SITE 015	SCRAP METAL STORAGE AREA		5 µg/L	2.5425	SSP; EE/CA; RA underway
IR SITE 032	FAST COOK-OFF PIT AND POND	AOC F	Not Detected	1.1028	NFA
IR SITE 040	BUILDING 120B DRMO LOT	OLD SWMU 014	Not Detected	0.7133	NFA
IR SITE 044	ROCKET MOTOR PIT	OLD SWMU 041	Not Detected	0.0281	NFA
IR SITE 047A	WWI MUNITIONS MOUND	OLD SWMU 050	Not Detected	0.6334	EE/CA RA comp
IR SITE 061A	GAMBO CREEK ASH DUMP		Not Detected	2.1284	RI/FS comp; SSP comp
IR SITE 061B	GAMBO CREEK PROJECTILE DISPOSAL		Not Detected	0.1841	CLOSED
IR SITE 062	BUILDING 396		Not Detected	0.0440	RI/FS; ROD-RA comp

There is currently no federal maximum contaminant level (MCL) for perchlorate; however, the Unregulated Contaminant Monitoring Rule (UMCR) requires public water systems serving more than 10,000 people and some smaller systems specifically chosen by the EPA or their primacy State to monitor drinking water for perchlorate. Risk assessment defines the health risks associated with perchlorate and assigns a new reference dose (maximum daily intake value) of 0.00003 mg/kg – day to protect human health. This reference dose could result in a regulatory MCL in drinking water of 1 ppb or less (0.001 mg/L, assuming a 70 kg adult consuming 2 liters of water per day). If it is determined in 2006 that perchlorate should be regulated, a final regulation is expected by 2010. If perchlorate is determined to be an urgent threat to public health under the mechanisms of the Safe Drinking Water Act, the regulatory process could be expedited (USATHAMA 2002).

Widespread detection of perchlorate has occurred nationwide in areas heavily supporting munitions storage and testing and perchlorate salts manufacturing. The Table below shows current State guidance on perchlorate in drinking water aimed at protecting health. These limits may be used to set individual clean up levels at contamination sites in the respective states. States not shown do not currently have health related guidance or regulatory limits for perchlorate in drinking water and defer to federal guidance..

State Regulation / Health Guidance for Perchlorate in Drinking Water (USATHAMA 2002, MERIT 2006)

State	Regulation Type	Health Guidance
Texas	Interim Drinking Water Action Level	4 ppb
	Residential Groundwater Cleanup Protective Concentration Level (PCL)	17 ppb
	Industrial / Commercial PCL	51 ppb
California	Action Level	4 ppb
	Draft Public Health Goal	6 ppb
Arizona	Health-Based Guidance Level	14 ppb
Maryland	Advisory level	1 ppb
Massachusetts	Maximum Contaminant Level	2 ppb
New York	Drinking Water Planning Level	5 ppb
	Public Notification Level	18 ppb
New Jersey	Draft MCL	6 ppb
New Mexico	Interim Health Based goal	1 ppb
Nevada	Public Notice Standard	18 ppb

Form 14. Installation Restoration Interview Record (continued)

16. Have hazardous substances, pollutants, contaminants, or petroleum-based products from the range been released off range? (circle) **Yes** **No**

If yes, describe releases (number of sites, location of on-range source of release, location of off-range site, chemicals, and quantities) and whether and to whom releases were reported:

Munitions were identified during RA pre-design at Site 37 (Small Caliber/Machine Gun Range). The site consists of gun butt sand deposited on the shoreline area. Excavation plan will require more extensive safety-arc setback which will impact nearby admin offices, housing, critical research and development operations, and navigable waterways for extended periods of time. Although, multimedia environmental sampling did not indicate a release of MECs based on 1996-2001 analyses, the potential presence of MECs is very high including 40-mm anti-personnel munitions from range activities extending offshore. Any release of MCs from the Small Caliber/Machine Gun Range will be to the Potomac River Range.

Explosives releases to groundwater have been reported from Site 2- Fenced Ordnance Burial Area located at the western boundary of the Missile Test Range. The burial area was used to dispose of excess munitions. Concentrations of 1,3-DNB (0.19 u/L), 2-NT (1.1 ug/L), 4-NT (3.5 ug/L), HMX (1.9 ug/L), and RDX (0.2 ug/L) reported in October 2005. The site area has undergone a removal action and is currently in long term monitoring. Site 2 is located immediately north of Gambo Creek.

Historical releases from range-adjacent site areas including IR Site 16 (1.2 Mgal JP-2 tank) and IR Site 12 (Chemical Burn Area) indicate potential for unresolved fuel (Site 16) or VOC, MEC (Site 12) releases to groundwater. Site 12 is currently undergoing air sparging/soil vapor extraction remediation. Site 16 was remediated by removing the tank and contaminated soil, however, the period of tank losses prior to remediation is unknown. VOCs detected in Site 12 groundwater consist of 1,1,2,2-TCA 2 ug/L), 1,1-DCA (1 to 11,000 ug/L), 1,1-DCA (1 to 6,200 ug/L), 1,1,1-TCA (1-100,000 ug/L)toluene (1 to 1,700 ug/L). MEC in groundwater consisted of RDX (1.2 to 4.7 ug/L). Sites 12 and 16 are located in the Gambo Creek drainage area. . Environmental releases from the sites would be transported via Gambo Creek to the Potomac River Range.

Off range chemical releases have generally not been detected by installation, however, groundwater monitoring at the eastern range boundary is not comprehensive in terms of well placements or analytical suites for existing wells. Release of ordnance-related debris to beach area on eastern shore of Missile Test Range was observed during site tour. Site area has been designated as Old Battery Plate Munitions Area. The debris source is a land based burial that is undergoing exposure through bluff erosion on the shoreline. EOD personnel routinely sweep beach area for ordnance following storm events and remove ordnance pieces. Iron oxides (and possibly other metals or munitions constituents) are leaching from the debris components and precipitating on the shore. The site area is out of the purview of the IR program because of the encountered munitions and has not been addressed by the Munitions Response Program yet. IR department encountered munitions during incidental trenching associated with an adjacent site area (IR Site 47B) and estimates that the burial may encompass approximately 2 acres and extends into the Potomac River Range.

17. Does this range have any sites where munitions were buried for disposal? (circle) **Yes** No

If yes, describe sites IR sites associated with munitions burial on active test ranges are summarized below.

Site #	Site Name	Size (acre)	Range
IR SITE 002	FENCED ORDNANCE BURIAL AREA	4.70	Missile Test Range
IR SITE 005	PROJECTILE DISPOSAL AREA	0.82	Terminal Range
IR SITE 009	DISPOSAL/BURN AREA	7.91	West of Missile Test Range
IR SITE 017	1400 AREA LANDFILL	7.58	North of Missile Test Range
IR SITE 044	ROCKET MOTOR PIT	0.03	West of Missile Test Range
IR SITE 047A	WWI MUNITIONS MOUND	0.63	Missile Test Range
IR SITE 057	SHELL HOUSE DUMP	1.87	West of Missile Test Range
IR SITE 61A	GAMBO CREEK ASH DUMP	2.13	West of Missile Test Range
IR SITE 61B	GAMBO CREEK PROJECTILE DISPOSAL	0.18	Terminal Range

18. Are any of the sites listed above designated IR sites? (circle) **Yes** No

If yes, describe:

IR Sites 1 and 5 previously designated under Environmental Restoration – Navy (ERN) funding will be removed because of presence of ordnance on active range. The remaining sites were addressed under the IR program.

19. Have any steps been taken to characterize, contain, or remediate range IR sites? (circle) **Yes** No

Explain: IR and SWMU sites on Main Side and EEA have undergone environmental investigations leading to the development of ROD and site closure for many of the identified site areas. The status of the sites is summarized below:

Form 14. Installation Restoration Interview Record (continued)

	Site	Status	SWMU_SITE	Area (acres)	SITE
1	IR SITE 001	Located on active range	AOC J	253.9633	OLD BOMBING RANGE
2	IR SITE 002	ROD-RA comp; LTM	OLD SWMU 046	4.7036	FENCED ORDNANCE BURIAL AREA
3	IR SITE 003	NFA	OLD SWMU 042	0.0206	ORDNANCE BURN STRUCTURE
4	IR SITE 004	Site Screening Process Report SSP;EE/CA; Removal underway		2.5425	CASE STORAGE AREA
5	IR SITE 005	Located on active range	OLD SWMU 051	0.8179	PROJECTILE DISPOSAL AREA
6	IR SITE 006	ROD; monitoring	OLD SWMU 054	2.3364	TERMINAL RANGE AIRPLANE DUMP
7	IR SITE 009	ROD; LTM; Wetlnd monitoring	OLD SWMU 019	7.9122	DISPOSAL/BURN AREA
8	IR SITE 010	ROD; LTM	AOC N	12.4910	HIDEAWAY POND
9	IR SITE 012	Amended Record of Decision AROD underway; RA completed	OLD SWMU 044	0.1771	CHEMICAL BURN PIT
10	IR SITE 013	NFA	OLD SWMU 031	0.4130	GAMBO CREEK TRUCK WASH AREA
11	IR SITE 014	SSP; EE/CA	OLD SWMU 028	0.3766	CW EVAPORATION POND
12	IR SITE 015	SSP; EE/CA; RA underway		2.5425	SCRAP METAL STORAGE AREA
13	IR SITE 016	CLOSED	OLD SWMU 016	4.8682	OIL LEAK (TANK #280)
14	IR SITE 017	ROD; LTM	OLD SWMU 030	7.5758	1400 AREA LANDFILL
15	IR SITE 018	CLOSED	AOC X	0.2588	CLASSIFIED DOCUMENT INCINERATOR
16	IR SITE 019	NFA	AOC G	0.1070	TRANSFORMER DRAINING AREA
17	IR SITE 020	RI; FFS	OLD SWMU 083	0.0092	FORMER ELECTROPLATING WASTE US
18	IR SITE 021	NFA	OLD SWMU 052	0.0558	GUN BARREL DECOPPERING AREA
19	IR SITE 022	NFA	OLD SWMU 053	0.1277	GUN BARREL DEGREASING AREA NOR
20	IR SITE 023	FFS	OLD SWMU 072	0.8984	BUILDING 480 LOT (PCB STORAGE)
21	IR SITE 025	RA Completed; wetland monitoring	OLD SWMU 066	6.6188	PESTICIDE RINSE AREA
22	IR SITE 028	CLOSED	OLD SWMU 131, 20B	0.0025	GAMBO CREEK COMPOST AREA
23	IR SITE 029	NFA	OLD SWMU 079	0.0144	BATTERY SERVICE AREA
24	IR SITE 031	NFA	OLD SWMU 006	1.5931	AIRPLANE PARK DUMP
25	IR SITE 032	NFA	AOC F	1.1028	FAST COOK-OFF PIT AND POND
26	IR SITE 033	CLOSED	AOC A	0.3212	OTTO FUEL SPILL
27	IR SITE 036	NFA	AOC C1	0.2654	DU MOUND EEA MIXED W
28	IR SITE 037	AROD underway	OLD SWMU 108	4.1910	LEAD CONTAMINATION AREA
29	IR SITE 038	NFA	AOC I	0.3152	B-1349 PEST CONTROL OUTSIDE AR
30	IR SITE 039	CLOSED	AOC X7	1.1615	OPEN STORAGE AREA MAIN BATTERY
31	IR SITE 040	NFA	OLD SWMU 014	0.7133	BUILDING 120B DRMO LOT
32	IR SITE 041	CLOSED	OLD SWMU 20A	0.2099	COMPOST AREA
33	IR SITE 043	NFA	OLD SWMU 035	0.3870	HIGLEY ROAD LAND APPLICATION
34	IR SITE 044	NFA	OLD SWMU 041	0.0281	ROCKET MOTOR PIT
35	IR SITE 045	NFA	OLD SWMU 045	2.1443	JULY 28, 1992 LANDFILL B
36	IR SITE 046	RA completed; wetland monitoring	OLD SWMU 047	1.8715	JULY 28, 1992 LANDFILL A: STUMP Dump Road
37	IR SITE 047A	EE/CA RA compete	OLD SWMU 050	0.6334	WWI MUNITIONS MOUND
38	IR SITE 047B	EE/CA RA compete	OLD IR SITE 34	0.0100	BARBETTE/DU CONTAMINATION
39	IR SITE 048	CLOSED	OLD SWMU 067	0.0554	BUILDING 448 TAR TANK OIL STORAGE
40	IR SITE 049	NFA	AOC C4	0.0618	BUILDING 200 DEPLETED URANIUM
41	IR SITE 050	NFA	OLD SWMU X9	4.5515	FILL AREAS NORTHEAST EEA (OBJE

Form 14. Installation Restoration Interview Record (continued)

	Site	Status	SWMU_SITE	Area (acres)	SITE
42	IR SITE 051	NFA	OLD SWMU 098	0.0200	BATTERY LOCKER ACID DRAINING A
43	IR SITE 053	NFA	OLD SWMU 126	0.0014	OWS 207-300
44	IR SITE 054	CLOSED	OLD SWMU 128	0.0178	OWS 1121 - OLD
45	IR SITE 055	NFA	OLD SWMU 129	9.5431	COOLING POND
46	IR SITE 056	NFA	OLD SWMU 132	3.2774	GUN BARREL DEGREASING AREA, RA
47	IR SITE 057	SSP comp	OLD SWMU 133	1.8673	SHELL HOUSE DUMP
48	IR SITE 058	ROD- RA comp	OLD SWMU 134	1.0082	BUILDING 1350 LANDFILL
49	IR SITE 059	CLOSED	OLD SWMU 135	0.0917	OCTAGON PAD DUMP
50	IR SITE 061A	RI/FS comp; SSP comp		2.1284	GAMBO CREEK ASH DUMP
51	IR SITE 061B	CLOSED		0.1841	GAMBO CREEK PROJECTILE DISPOSA
52	IR SITE 062	RI/FS; ROD-RA comp		0.0440	BUILDING 396
53	SWMU 115	CLOSED		0.0008	BUILDING 1282 AUTO HOBBY OUTSI
54	SWMU 061	CLOSED		0.0007	PAINT CAN CRUSHER
55	SWMU 101	CLOSED		0.0044	BUILDING 155 AUTO SHOP WASTE O
56	SWMU 070	CLOSED		0.0095	BUILDING 152 TCE AA
57	AOC Q	CLOSED		1305.6543	MACHODOC CREEK
58	SWMU 064	CLOSED		0.1204	BUILDING 448, SANDBLAST AREA
59	SWMU 003	CLOSED		0.0356	B-194 AA
60	SWMU 082	CLOSED		0.0371	ELECTROPLATING LINE AND WWT
61	SWMU 078	CLOSED		0.0048	BUILDING 1121 FORMER WASTE OIL
62	AOC 0	CLOSED		0.0050	BUILDING 1369 PESTICIDE SPILL
63	SWMU 023	CLOSED		0.0009	BUILDING 456 OIL WASTE DRUM
64	OTHER UNITS C3	CLOSED		1.5835	SCAR AT PHALANX TEST AREA
65	SWMU 130	CLOSED		0.0042	YARDCRAFT OIL STORAGE AREA
66	IR SITE 060	CLOSED	SWMU 057	0.0117	BUILDING 445 STAR GUAGE LOADIN
67	SWMU 127	CLOSED		0.0255	OWS 121-300, OWS 115-350, OWS
68	ADDITIONAL AREA X6	CLOSED		0.2056	SOUTH HANGAR FORMER TANK AREA
69	Located on active range	CLOSED	AOC Z	0.0433	TERMINAL RANGE BUILDING 109
70	SWMU 027	CLOSED		2.0015	TANK 280 CONTRACTOR STAGING AR
71	SWMU 119	CLOSED		0.0063	BUILDING 1282 AUTO HOBBY USED
72	SWMU 062	CLOSED		0.0057	PAINT CAN DUMPSTER
73	SWMU 015	CLOSED		0.0857	BUILDING 120B CONTRACTOR STAGI
74	OTHER UNITS C6	CLOSED		4.1070	FORMER RADIO TESTING AREA
75	IR SITE 052	CLOSED	SWMU 125	0.0002	OWS 107-350 (YARDCRAFT AREA)
76	SWMU 077	CLOSED		0.1051	BUILDING 1329 WASH AREA
77	AOC P	STATUS		224.2324	GAMBO CREEK

Form 14. Installation Restoration Interview Record (continued)

20. Has the range determined if any IR sites pose a substantial threat to public health or the environment? (circle) **Yes** No

Explain:

Many of the IR sites have undergone remediation leading to ROD determinations for NFA, LTM, or have been closed. Unresolved site areas including Sites 1 and 5 (munitions present on active range) and the recently discovered Old Battery Plate Munitions Area represent munitions related sites with proximity to public access areas (shoreline) and with uncharacterized potential for munitions-related releases to the environment.

Munitions were identified during RA pre-design at Site 37 (Small Caliber/Machine Gun Range). The site consists of gun butt sand deposited on the shoreline area. Excavation plan will require more extensive safety-arc setback which will impact nearby admin offices, housing, critical research and development operations, and navigable waterways for extended periods of time. Although, multimedia environmental sampling did not indicate a release of MECs based on 1996-2001 analyses, the potential presence of MECs is very high including 40-mm anti-personnel munitions from range activities extending offshore. Any release of MCs from the Small Caliber/Machine Gun Range will be to the Potomac River Range.

Off range chemical releases have not been detected by installation, however, groundwater monitoring at the eastern range boundary is not comprehensive in terms of well placements or analytical suites for existing wells. Release of ordnance-related debris to the beach area on eastern shore of Missile Test Range was observed during site tour. Site area has been designated as Old Battery Plate Munitions Area. The debris source is a land based burial that is undergoing exposure through bluff erosion on the shoreline. EOD personnel routinely sweep the beach area for ordnance following storm events and remove ordnance pieces. Iron oxides (and possibly other metals or munitions related constituents) are leaching from the debris components and precipitating on the shore. IR investigations at an adjacent site area encountered munitions during incidental trenching and estimates that the Old Battery Plate Munitions Area burial may encompass approximately 2 acres.

If yes, what is being done to mitigate risks to public and environment?

Sites 1 and 5 are pending transfer to Military Munitions Response Programs (MMRP). Site 37 will be undergoing remediation. Response action at shoreline munitions site is pending.

21. Is there a concern, by the Navy, regulatory agency, and/or public, regarding the off-range release of toxic chemicals and their possible impact on the surrounding community and environment? (circle) **Yes** No

If yes, describe:

IR personnel on Dahlgren NSWC expressed concern regarding the status of the Old Battery Plate Munitions Area and a timetable for mitigating the shoreline bluff erosion and the release of ordnance pieces form the bluff. Public concerns have been expressed over chemical constituents being released on the water-based ranges, however, there has not been concern regarding land-based range releases.

Public Involvement

22. Does the range have a Restoration Advisory Board (RAB) for any of the IR sites? (circle) **Yes** No

If yes, explain:

Dahlgren NSWC participates in partnering meetings with the USEPA, Navy, and VDEQ. These agencies meet jointly with the RAB on a monthly basis although public attendance is generally regarded as sparse.

23. In addition to or in lieu of a RAB, does the range have a proactive public involvement program that allows the Navy and public to exchange information and concerns regarding IR sites and off-range releases? (circle) **Yes** No

Explain:

Dahlgren NSWC outreach maintains contact with the public through the RAB committee, operation of an informational website, and community interaction through a Public Affairs Office (PAO) liaison. The ATDSR recently conducted a Public Health Assessment (October, 2006) for the activities and operations at Dahlgren.

24. Is a procedure in place for receiving and responding to all public inquiries regarding the range and IR sites? (circle) **Yes** No Explain:

Requests from the public are directed to responsible individuals in the IR department or are managed by the PAO liaison.

25. What are the issues of concern expressed by the public?

Describe:

Predominantly noise/vibration related.

Regulatory Impacts on Range

26. Have Federal or State regulators issued the range any NOV for CERCLA noncompliance? (circle) Yes **No**

If no, proceed to next question. If yes, who issued the NOV, what were the deficiencies and how are deficiencies being resolved?

Form 14. Installation Restoration Interview Record (continued)

27. Have any requirements from the Navy or a regulatory agency regarding IR site management negatively impacted range operations? (circle) **Yes** No If yes, state the requirements and negative impacts: *Remedial actions implemented at some IR site areas (e.g., Site 37) will affect range operations as a result of short term access requirements of the actions. The excavation plan will require more extensive safety-arc setback which will impact nearby admin offices, housing, critical research and development operations, and navigable waterways for extended periods of time. Although, multimedia environmental sampling did not indicate a release of MECs based on 1996-2001 analyses, the potential presence of MECs is very high including 40-mm anti-personnel munitions from range activities that extended into the Potomac River.* *Ordnance-related debris exposures on the beach area of the Missile Test Range require periodic EOD sweeps to remove ordnance following storm events. Iron oxides and possibly other metals or munitions constituents are leaching from the debris components and precipitating on the shore. Clean up of this area may negatively affect this portion of the Missile Test Range.*
28. Do you have copies, preferably electronic, of any range IR related documents including, but not limited to, list of IR sites, any release notifications, any communications regarding IR sites, Public Outreach Plan, description of RAB, and any studies or reports pertaining to IR sites? List all documents obtained: *Dahlgren GIS layers* *Environmental Restoration Site Management Plan, JM Waller Associates June 2006* *Site 2 Fenced Ordnance Burial Area Record of Decision September 1997* *Site 10 Hideaway Pond Record of Decision, September 2000* *Site 12 Chemical Burn Area Record of Decision, September 1997* *Site 25 Pesticide Rinse Area Record of Decision, September 1999* *Site 31 Airplane Park Dump Record of Decision September 2003* *Site 37 Record of Decision Amendment, August 2006* *Site 36 Depleted Uranium Mound EEA, Site 49 Depleted Uranium Gun Butt Record of Decision, September 2001* *Site 46 Landfill A Stump Dump Road Record of Decision, September 2001* *Site 47B – Excavation Trenches February 2005* *Managing Noise at Dahlgren, Dahlgren PAO Fact sheet, June 2005* *Site 50 Fill Area Northeast EEA Site Decision Document July 2003*
Documents
Site 61b Gambo Creek Projectile Disposal Area Final Decision Document *Hydrogeologic and Water Quality Data for the Main Side, NSWC, Dahlgren, USGS OFR 94-301* *Hydrogeology and Water Quality of the shallow Aquifer System at the Main Side NSWC, Dahlgren USGS WRIR 96-4055*

[1] As defined by Section 101(22) of CERCLA, release means “any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing into the environment (including the abandonment or discarding of barrels, containers and other closed receptacles, containing any HS, pollutant or contaminant), but excludes any release that results in exposure to persons solely within a workplace….” ‘For purposes of the NCP (National Contingency Plan, release also means threat of release.’ (Source: OPNAVINST 5090.1B CH-4, Chapter 15, Installation Restoration, 9 September 1999).

[2] Hazardous Substance. For the purposes of the IR Program, hazardous substance is as defined in CERCLA Section 101(14) and designated under reference (b). This includes materials that, “because of quantity, concentration, physical, chemical or infectious characteristics, may pose a substantial hazard to human health or the environment when released or spilled.” (Source: OPNAVINST 5090.1B CH-4, Chapter 15, Installation Restoration, 9 September 1999).

[3] Pollutant. As defined by Section 101(33) of CERCLA, pollutant includes, but is not limited to, any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions or physical deformation, in such organisms or offspring.’ (Source: OPNAVINST 5090.1B CH-4, Chapter 15, Installation Restoration, 9 September 1999).

Form 15. Storage Tank and POL Management Interview Record

Point of Contact (POC) Information		
1. Date: 10/30/06	2. Time: 1330	3. Location: Building 189
4. Tactical Theater Name: Not applicable		
5. Range Complex Name: Not applicable		6. Range Name: Main Side Ranges, EEA
7. Name of POC Interviewed:		
8. POC Title: Environmental Protection Specialist (Hazardous Materials Management)		
9. E-mail Address:		10. Phone Number:
11. POC Navy Command Affiliation: Navy District of Washington (NDW)		
12. Dept./Div./Branch: Safety And Environmental		13. Contractor? (circle) Yes **No**
14. Name and Affiliation of Interviewer: SAIC, RSEPA Technical Team		

Storage Tanks (UST)

15. Does this range have any USTs or ASTs? (circle) **Yes** No
Are any of the USTs or ASTs located on operational range areas? (circle) **Yes** No N/A
If yes, state number, type, and location of each tank:

USTs

Range	Tank ID	Use	Regulated	Tank Capacity/ Contents
AA Fuze Range	EHTNKUST-2002-119	IN_USE UST	YES	4000 GAL #2 FUEL OIL
AA Fuze Range	EHTNKUST-2002-120	IN_USE UST	YES	1000 GAL #2 FUEL OIL
EEA	EHTNKUST-2002-194	IN_USE UST	YES	275 GAL #2 FUEL OIL
EEA	EHTNKUST-2002-195	IN_USE UST	YES	275 GAL #2 FUEL OIL
EEA	EHTNKUST-2002-196	IN_USE UST	YES	1000 GAL GASOLINE RVP13
Main Range	EHTNKUST-2002-121	IN_USE UST	YES	275 GAL #2 FUEL OIL
Main Range	EHTNKUST-2002-122	IN_USE UST	YES	4000 GAL #2 FUEL OIL
Main Range	EHTNKUST-2002-123	IN_USE UST	YES	550 GAL #2 FUEL OIL
Main Range	EHTNKUST-2002-124	IN_USE UST	YES	3000 GAL #2 FUEL OIL
Main Range	EHTNKUST-2002-139	IN_USE UST	YES	4000 GAL #2 FUEL OIL
Main Range	EHTNKUST-2002-178	IN_USE UST	YES	2500 GAL #2 FUEL OIL
Missile Test Range	EHTNKUST-2002-143	IN_USE UST	YES	550 GAL #2 FUEL OIL
Missile Test Range	EHTNKUST-2002-180	IN_USE UST	YES	550 GAL #2 FUEL OIL
Terminal Range	EHTNKUST-2002-140	IN_USE UST	YES	500 GAL #2 FUEL OIL
Terminal Range	EHTNKUST-2002-141	IN_USE UST	YES	550 GAL #2 FUEL OIL
Terminal Range	EHTNKUST-2002-159	IN_USE UST	YES	275 GAL #2 FUEL OIL

ASTs

Range	Tank ID	Use	Regulated	Tank size/contents
EEA	EHTNKAST000003	IN_USE AST	YES	275 GAL #2 FUEL OIL
EEA	EHTNKAST000029	IN_USE AST	YES	500 GAL DIESEL
EEA	EHTNKAST000041	IN_USE AST	YES	100000 GAL WATER TANK
EEA	EHTNKAST000043	IN_USE AST	YES	10000 GAL WASTEWATER
EEA	EHTNKAST000042	IN_USE AST	YES	300 GAL WATER
EEA	EHTNKAST000002	IN_USE AST	YES	275 GAL #2 FUEL OIL

16. Does this range have a current Tank Management Plan? (circle) **Yes** No N/A
Spill Prevention, Control, And Countermeasures Plan And Tank Management Plan, Safety & Environmental Office, NSWCDL Dahlgren Site, 17320 Dahlgren Road, Dahlgren, VA 22448-5100, April 2003.

17. Do all range USTs have secondary containment? (circle) **Yes** No N/A
NSWCDL's USTs are Underwriter's Laboratory (UL) approved tanks. All of the tanks meet Virginia UST regulatory requirements (9 VAC 25-580) and Federal UST regulatory requirements (40 CFR 280) for leak detection, secondary containment, and corrosion protection. Tanks are double walled and tested annually. A UST removal and replacement project, completed in the summer of 1992, replaced all regulated USTs and several heating oil tanks to meet Virginia and Federal UST regulatory requirements.

All drum-storage areas have secondary spill containment that is adequate to prevent the release of oil to navigable waterways. All drums are stored without direct ground contact, i.e. on pallets or platforms, such that all sides of the drums are visible.

Form 15. Storage Tank and POL Management Interview Record (continued)

18. Do all range UST systems[1] have corrosion protection systems, such as cathodic protection, that are routinely inspected and maintained? (circle) **Yes** No N/A

NSWCDL's USTs are Underwriter's Laboratory (UL) approved tanks. All of the tanks meet Virginia UST regulatory requirements (9 VAC 25-580) and Federal UST regulatory requirements (40 CFR 280) for leak detection, secondary containment, and corrosion protection. A UST removal and replacement project, completed in the summer of 1992, replaced all regulated USTs and several heating oil tanks to meet Virginia and Federal UST regulatory requirements.

19. Are all range UST systems equipped with spill/overfill prevention equipment and have an approved method of release detection? (circle) **Yes** No N/A

NSWCDL's USTs are Underwriter's Laboratory (UL) approved tanks. All of the tanks meet Virginia UST regulatory requirements (9 VAC 25-580) and Federal UST regulatory requirements (40 CFR 280) for leak detection, secondary containment, and corrosion protection. A UST removal and replacement project, completed in the summer of 1992, replaced all regulated USTs and several heating oil tanks to meet Virginia and Federal UST regulatory requirements. NSWCDL performs release detection monitoring by groundwater monitoring on older USTs, interstitial monitoring by liquid-level sensing on newly installed (1991 or later) USTs, and by visual inspection of ASTs and petroleum product storage locations. Alarm systems for interstitial monitoring have been installed for 19 USTs at 16 locations.

All petroleum products are delivered to NSWCDL by vendors with their own equipment. No. 2 fuel oil, gasoline, diesel fuel, and kerosene are transferred directly from the vendor's truck to the appropriate UST or AST. Lubricating oils, hydraulic oils, transmission fluids, motor oils, and greases are delivered in 55-gallon drums, 5-gallon containers, or consumer-size packages, and are stored near Building 120B, within Building 122, or within Building 114 prior to delivery to each unit for their storage and use. Vendor tankers transfer the No. 2 fuel oil to each individual No. 2 fuel oil UST or AST. Individual tank filling occurs through a top-loading transfer pipe and on an as-needed basis as determined by computer calculations of fuel usage.

The transfer point (tanker load/unload location) for UST272A and UST 272B at the vehicle fueling area has containment to catch fuel spills during loading and unloading. The transfer point at UST 231A and UST 231B at the Yardcraft area has sufficient secondary containment to retain fuel spilled during product loading and unloading at the tank only. Spilled fuel is returned to the tank by means of a drain valve. Secondary containment is covered with a manhole cover to minimize accumulated precipitation. Accumulated precipitation or small spills from material transfer operations are returned to the tank by the drain valve. The transfer point at the Power House (Building 248) has secondary containment sufficient to retain fuel spilled during product loading and unloading. Spilled fuel will flow into the Oil/Water Separator (OWS 402), which has a capacity for 12,000 gallons of oil. No secondary containment is present while fueling vehicles directly from NSWCDL tankers. This type of fueling activity is done primarily for heavy equipment that cannot be moved to a secure fueling site, such as cranes, and for helicopters on the runway. When vessels are fueled at the docks of the Yardcraft area (UST 231A and UST 231B), personnel are prepared to utilize emergency containment booms to prevent a potential spill from spreading away from the immediate dock area.

20. Do all ASTs have a release detection system in place? (circle) **Yes** No N/A

All ASTs are visually monitored by employees and the SPCC Plan Coordinator on a regular basis. Employees are required to notify a supervisor of leaks or damage to an AST or drum. The SPCC Plan Contractor also reports identified deficiencies to the SPCC Plan Coordinator, who submits a work request to have the deficiency corrected. All valves that permit outflow of a tank's contents are kept closed and locked when not in operation. All ASTs are either double-wall, located in secondary containment structures, or within buildings. Walls and floors of secondary containment structures are sufficiently impervious to the stored products. Tank structures are elevated above the top of the containment structure. All ASTs have been tested and 25 year certified.

21. Have any storage tanks been removed from the ranges? (circle) **Yes** No N/A

ENVUST_ID	Status	Regulated	NARRATIVE	FUEL_TYPE
EHTNKUST-2002-117	CLOSEDREMOVED	YES	550 GAL #2 FUEL OIL	FUELOIL2
EHTNKUST-2002-118	CLOSEDREMOVED	YES	1000 GAL #2 FUEL OIL	FUELOIL2
EHTNKUST-2002-132	CLOSEDREMOVED	YES	500 GAL #2 FUEL OIL	FUELOIL2
EHTNKUST-2002-142	CLOSEDREMOVED	YES	550 GAL #2 FUEL OIL	FUELOIL2
EHTNKUST-2002-179	CLOSEDREMOVED	YES	1000 GAL #2 FUEL OIL	FUELOIL2
EHTNKUST-2002-191	CLOSEDREMOVED	YES	350 GAL OIL/WATER SEPARATOR	FUELOIL2
EHTNKUST-2003-001	CLOSEDINPLACE	YES	2000 GAL #2 FUEL OIL	FUELOIL2
EHTNKUST-2003-002	CLOSEDINPLACE	YES	3000 GAL #2 FUEL OIL	FUELOIL2
EHTNKUST-2003-003	CLOSEDREMOVED	YES	1500C #2 FUEL OIL	FUELOIL2
EHTNKUST-2002-177	CLOSEDREMOVED	YES	1500 GAL #2 FUEL OIL	FUELOIL2
EHTNKUST-2005-001	CLOSEDREMOVED	YES	625 GAL #2 FUEL OIL	FUELOIL2
EHTNKUST-2005-002	CLOSEDREMOVED	YES	6000 GAL #2 FUEL OIL	FUELOIL2
EHTNKUST-2005-003	CLOSEDREMOVED	YES	1000 GAL #2 FUEL OIL	FUELOIL2

Form 15. Storage Tank and POL Management Interview Record (continued)

If yes, have any of these tanks leaked and resulted in an IR site? Explain:
IR Site 47B: 625 gallon #2 Fuel Oil tank removed; 1 MG tank (#280) containing #2 Fuel oil located west and upgradient of Missile Test Range removed and closed. Approximately 300 tons of soil removed (IR site 16).

POL

22. Does this range have a current Spill Prevention Control and Countermeasure (SPCC) Plan? (circle) **Yes** No
Spill Prevention, Control, And Countermeasures Plan And Tank Management Plan, Safety & Environmental Office, NSWCDL Dahlgren Site, 17320 Dahlgren Road, Dahlgren, VA 22448-5100, April 2003.

23. Does this range have a current Oil and Hazardous Substances Facility Response Plan (FRP)? (circle) **Yes** No
Components of an FRP are included within the Spill Prevention, Control, and Countermeasures Plan and Tank Management Plan, April 2003.

24. Does this range have a spill response training program in place? (circle) **Yes** No
The spill response training program is included within the Spill Prevention, Control, And Countermeasures Plan And Tank Management Plan, April 2003.

25. Have any POL spills occurred within the past 3 years at either range or range support facilities? (circle) **Yes** No
Non-range or support tanks. Three leaking USTs were identified in the Public works housing area. Privatization in housing will replace all fuel oil USTs with propane USTs. 625 gal oil storage tank removed/closed out (IR Site 47b). 1 MG tank (#280) containing #2 Fuel oil located west of Missile Test Range removed and closed. Approximately 300 tons of soil removed (IR site 16).

From the SPCC: The most probable sources of a spill would be structural or equipment failure, operational error, or collision. Equipment failure or operational error, either during product transfer or storage, could cause a spill from any of the petroleum storage areas. Structural or equipment failure could include tank or line rupture due to corrosion; leaks through tank seams; leaks from piping, fittings, joints, or gaskets; and valve or seal rupture. Operational error and "poor housekeeping" includes improper operation of transfer or storage equipment, inadequate maintenance to systems including seals, filters, and drainage systems, and the overfilling of an oil or fuel tank, hydraulic reservoir, or gear-oil reservoir. The possibility of collision exists near ASTs. Collisions could occur with vehicles, including forklifts, material-handling apparatus, or aircraft. A tipped fuel tanker or heavy equipment also could cause a fuel spill.

Another potential spill source would include an equipment failure allowing oil, grease, fuel or hydraulic fluid to accumulate in either the Ground Plane or Gun Mount sumps. These are open sumps that primarily accumulate stormwater. There are three active Gun Mounts at the Main Range, and one active Gun Mount at the Terminal Range each having a sump that discharges to a VPDES permitted outfall (Main Range to outfalls 002, 003, and Terminal Range to outfall 007). In addition, the Ground Plane area has two sumps that discharge to the Cooling Pond, which ultimately discharges to VPDES permitted outfall 004. During weekly inspections, the product is removed if a sheen is observed and, the sump water sampled and analyzed for oil/grease and pH. Providing these parameters are below VPDES permit limits, the sumps are discharged to the respective storm sewer or outfall in accordance with the Stormwater Pollution Prevention Plan (SWPPP).

If yes, how many of these spills were reported and to what agencies?
Spills were reported to VDEQ. Regulated tank closures on NSFD were completed with regulatory (VDEQ) concurrence.

Regulatory Impacts on Range

26. Have Federal or State regulators issued the range any NOVs for noncompliance with Federal or State UST, AST, or POL laws? (circle) Yes **No**
If no, proceed to next question. If yes, what agency issued the NOV, what were the deficiencies, and how were the deficiencies resolved?

27. Have any requirements from the Navy or a regulatory agency regarding UST/AST/POL management negatively impacted range operations? (circle) Yes **No**
If yes, state the requirements and negative impacts on range operations:

Documents

28. Do you have copies, preferably electronic, of any range storage tank or POL management -related documents that include, but are not limited to the following: SPCC Plan, Spill Contingency Plan (SPC), FRP, Tank Management plan, NOVs, and regulatory agency inspection reports?
List all documents obtained:
Spill Prevention, Control, And Countermeasures Plan And Tank Management Plan, Safety & Environmental Office, NSWCDL Dahlgren Site, 17320 Dahlgren Road, Dahlgren, Va 22448-5100, April 2003.
Virginia Underground Storage Tanks: Technical Standards And Corrective Action Requirements.
9 Vac 25-91-10 Et Seq. Virginia Facility And Aboveground Storage Tank (AST) Regulation. (Effective June 24, 1998)

[1] UST System per OPNAVINST 5090.1B CH-4 is an underground storage tank and its piping.

Form 16. Safe Drinking Water Interview Record

Point of Contact (POC) Information		
1. Date: 1 November 2006	2. Time: 10:30 am	3. Location: Building 189, 2nd floor conference room
4. Tactical Theater Name: Not applicable		
5. Range Complex Name: Not applicable		6. Range Name: Explosive Experimental Area (Pumpkin Neck) Ranges: Harris Range and Churchill Range and Mainside ranges: Main Range (land based portion), Terminal Range, Shock Tube Road Range, Anti-Aircraft (AA) Fuze Range, Machine Gun Range, Missile Test Range
7. Name of POC Interviewed: Environmental Engineer for Naval Surface Warfare Center, Dahlgren Laboratory [NSWC DL]; Environmental Engineer for host command Naval District of Washington [NDW]		
8. POC Title: Environmental Engineer		
9. E-mail Address:		10. Phone Number:
11. POC Navy Command Affiliation: Naval Surface Warfare Center, Dahlgren Laboratory (NSWC DL)		
12. Dept./Div./Branch: Safety and Environmental (XDC8)		13. Contractor? (circle) Yes **No**
14. Name and Affiliation of Interviewer: SAIC, RSEPA Technical Team Members		
Potable Water		
15. Is there a source of potable water located on this range? (circle) **Yes** No If yes, is it surface water and/or groundwater? *Groundwater is the source of potable water on both the mainland (including Machine Gun Range, Anti-Aircraft Fuse Range, Terminal Range, and Missile Test Range), and the EEA Range (also referred to as Pumpkin Neck, which includes the Harris and Churchill Ranges). The Potomac Group aquifer is composed of three aquifers and three confining units collectively labeled as the Potomac Formation. The potable water is drawn from the upper aquifer. Three wells are used on the mainland area to draw drinking water; the Pumpkin Neck area also has its own well.* If no, where is the closest source of potable water from this range?		
16. Does the closest source of potable water serve Navy personnel, Navy housing, or nearby civilian communities? (circle) **Yes** No *Describe all who use water and for what purposes: The deeper Potomac Group aquifer underlying NSWC-Dahlgren provides drinking water to the NSWC-Dahlgren water systems and nearby municipal water systems. The shallower Nanjemoy aquifer provides drinking water to a small number of private residences (USEPA 2005).*		
17. Is the closest source of potable water drawing from a designated sole source aquifer? (circle) Yes **No** *The aquifer has not been designated as a sole source aquifer by EPA Region 3.* Where is this range located with respect to groundwater flow from the range? *A large clay lens is present under the OB/OD testing area at Pumpkin Neck and modeling indicates that the groundwater goes back and forth. The expectation from the area is that the groundwater direction would be northwest, but additional water sampling will be conducted to determine the groundwater flow direction at Pumpkin Neck for the shallow aquifers.*		
18. Is this range located in a recharge zone for a designated sole source aquifer? (circle) Yes **No**		
19. Does this range oversee the use of this closest source of potable water? (circle) Yes **No** If yes, proceed to next question. If no, who does? *The Virginia Department of Health, through the local health departments, permits all water supply wells including domestic wells. King George's county (where Dahlgren is located) is in the Virginia Department of Health, Rappahannock Health District (Quinlan 2006).*		
20. Does the range fit the SDWA description of owner or operator of a Public Water System (PWS)[1,2]? (circle) **Yes** No If yes, describe the PWS ("community"[3], "noncommunity nontransient"[4], or "noncommunity transient"[5]), the source, how many people it serves, and other uses of this PWS: If no, proceed to question 25. *For the Mainside area, the PWS is a community system. The operator category for the PWS is Class IV; the system serves approximately 5,600 individuals.* *EEA (Pumpkin Neck) has its own wells and is a separate distribution system. This system is considered noncommunity transient and only serves the individuals (less than 25) in the administration building.*		
21. Does this range, as PWS owner/operator, treat water prior to distribution? (circle) **Yes** No Describe the treatment methods: *The water is treated by a chlorine injection system that includes 150 pound chlorine cylinders prior to distribution.*		
22. Does this range, as PWS owner/operator, monitor water prior to distribution for EPA primary drinking water standards and total coliform? (circle) **Yes** No If yes, describe analytes that are routinely monitored: *Copper and lead are monitored every three years; drinking water standards (including pesticides, radionuclides, and total coliform) are monitored annually and published in the consumer confidence reports (distributed via website, building bulletin boards, and e-mail).*		

Form 16. Safe Drinking Water Interview Record (continued)

23. Has the PWS water exceeded MCL standards in the past year? (circle) Yes **No** If yes, what analytes exceeded MCL standards, were any NOVs issued, were any public notifications required, and what was done to correct exceedance(s)?
24. Has the PWS water exceeded action levels for lead and copper in the past year? (circle) Yes **No** If yes, was public notification required and what was done to correct exceedance(s)?
25. Does the range as PWS owner/operator have a cross connection control program? (circle) **Yes** No Explain: *A cross contamination control plan approved by the State and administered by NAVFAC is in place. Don King (technician) does annual inspections and records the results of the backflow prevention.*
26. Does this range as PWS owner/operator keep current records of all sampling results and analysis, monitoring, sanitary survey reports, actions taken to correct violations of drinking water standards, and any written reports or communications to Federal or State regulatory agency? (circle) **Yes*** No If no, explain: **These records are maintained by Brian Hornaman.*
27. Does the range have a current operation and maintenance program for its PWS? (circle) Yes **No*** Describe: **The range has an operation and maintenance program plan for its PWS that needs some minor updates concerning the well descriptions (taking out old wells that are no longer in use and adding the new wells and well descriptions). A contract has not been awarded yet for updating the O&M Plan in use.*
28. Does the range have a source of potable water that is not considered a "public water system" yet is still used for drinking water? (circle) Yes **No** If yes, describe the potable water source, any State or local safe drinking water requirements, who uses the water, and for what purpose(s).
29. Does this range receive potable water from a city water supply or from water that is transported via tank? (circle) Yes **No** Explain:
Nonpotable Water
30. Does this range have a source of nonpotable water? (circle) **Yes** No If yes, describe who uses water and for what purpose(s), if any. *The pier at EEA (Pumpkin Neck) has connections that can draw from the Creek. A fire station was housed at EEA in the 1940s that used this nonpotable water source for fire fighting activities.*
Source Water Protection
31. Has the Navy assessed whether any range military operations or range support facilities/operations could directly or indirectly contaminate a sole source aquifer through its recharge zone? (circle) **Yes** No Explain: *Semi-Annual monitoring of the groundwater wells is conducted as required by the Resource Conservation and Recovery Act (RCRA) Permit (EPA ID No. VA7170024684) for the Thermal Treatment of Hazardous Waste by Open Burning and Open Detonation (associated with the Pumpkin Neck Range).*
32. Has the Navy, regulatory agency, or the public expressed concerns regarding the release of MCs of potential concern or other chemicals off range that might contaminate a drinking water source? (circle) **Yes** No Explain: *Perchlorate sampling is occurring at the well surrounding the OB/OD operations at Pumpkin neck. Although the Navy does not feel any perchlorate may contaminate drinking water sources, sampling of wells around the OB/OD will be conducted to confirm that no constituents are migrating offsite.*
33. Has the Navy, a regulatory agency, or the public expressed concerns regarding the release of MCs of potential concern or other chemicals that might contaminate a range drinking water source? (circle) Yes **No*** Explain: *Although perchlorate and RDX were detected in the shallow wells at Pumpkin Neck exceeding the state action levels, the source of the drinking water wells at the range is very deep. The concentrations of these constituents are being addresses as part of the Corrective Action plan required by the RCRA permit (Vanessa Lovejoy).*

Form 16. Safe Drinking Water Interview Record (continued)

Regulatory Impacts on Range

34. Have Federal or State regulators issued this range any NOVs for noncompliance with Federal, State, or local drinking water standards? (circle) **Yes** No

If no, proceed to next question. If yes, what agency issued the NOV, what were the deficiencies and how are deficiencies being resolved?

NOVs were issued in 2004, 1998, 1997, 1993 and 1990. No NOVs have been issued in the last two years. Details for more recent NOVs are presented below:

In 2004, at the Mainside distribution, two positive samples were detected for total fecal coliform out of the thirteen samples collected. This was a temporary, isolated event that has not been repeated. The NOV was issued by Virginia Department of Health. To resolve, public notification was required. No additional resolution activities were required.

In 1998, at EEA, the results of the water indicated two positive samples of fecal coliform. Although an NOV was issued by the Virginia Department of Health, no resolution was required. Positive fecal coliform has not been detected in the water prior to or after this sampling event.

35. Have any requirements from the Navy or a regulatory agency regarding safe drinking water management negatively impacted range operations? (circle) Yes **No**

If yes, state the requirements and negative impacts on range operations:

Documents

36. Do you have copies, preferably electronic, of any safe drinking water management-related documents that include, but are not limited to, the following: Operations & Management Plan, sampling and analytical reports, public notification of noncompliance with drinking water standards, Sanitary Survey Report, NOVs, and regulatory agency inspection reports?

List all documents obtained:

- *Operations & Management Plan (reviewed)*
- *NOVs (reviewed)*

[1] Public Water System (PWS) – a public system for the provision of piped water for human consumption, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. Such system includes any collection, treatment, storage, and distribution facilities under the control of the operator of such system and is used primarily in connection with such system, and any collection or pretreatment storage facilities not under such control that are used primarily in connection with such system. A public water system is either a “community water system” or a “noncommunity water system.” (Source: OPNAVINST 5090.1B CH-4, Chapter 8, “Drinking Water Systems and Water Conservation”)

[2] Facilities that meet all the criteria listed below are not required to comply with the requirements of the SDWA since, by definition, they are not public water systems (40 CFR 141.3):

- System consists only of distribution and storage facilities and does not have any collection and treatment facilities
- The facility gets all of its water from a public water system that is owned or operated by another party
- The facility does not sell water to any party.

(Source: U.S. TEAM Guide, Section 13, Water Quality Management, December 2000)

[3] Community water system – a public water system that serves the same people year round.

[4] Noncommunity nontransient water system – a public water system that serves the same people more than 6 months, but not year round (i.e., a school with its own water supply).

[5] Noncommunity transient water system – a public water system that does not serve the same people for more than 6 months (i.e., a rest area or campground with its own water supply).

(Source for 3-5: EPA Safe Drinking Water Act Fact Sheet, “Understanding the Safe Drinking Water Act.”)

INTERVIEW REFERENCES

USEPA 2005. NPL Site Narrative for NSWC – Dahlgren. Online: http://www.epa.gov/superfund/sites/npl/nar1326.htm

Quinlan 2006. E-mail Communication between Office of Groundwater Withdrawal Permitting, Virginia Department of Environmental Quality and SAIC regarding Potable Well Surveys at Dahlgren

Form 17a. Operational Range Site Model – Operational Component

Operating Area Name	Range Complex Name	Range Name(s)
	Dahlgren Naval Surface Warfare Center	Missile Test Range Terminal Range Main Range Anti-Aircraft Fuze Range Machine Gun Range Explosive Experimental Area Range

Range Complex Location:

King George County, Virginia

Boundaries (Bottom/Top and Latitude/Longitude) and Size (acres for land/square miles for water):

See Figure 1-1

Installation Universal Identification Code (UIC):

00178

Regional Commander (Management):

Name:
Command: Naval Sea Systems Command
Title/Position:
Address:
Phone Number:
E-mail address:

Installation, Fleet Commands, and Other Echelon II Commands (Scheduling Authority):

NSWC DL G61

Who are the primary users of the range? List training groups, squadrons, other services, foreign countries, etc.

Navy RDT&E

Other Range-Related Facilities:

How long has this range been under military control?	Month/Year: October 1918
When was this range last used?	Month/Year: Current

When in use, how often was it used (check one)?

- ✓ Daily
- ❑ Weekly
- ❑ Monthly
- ❑ Unknown
- ❑ Other: ________________

How would you classify this range (check all that apply)?

- ✓ Research, Development, Testing, Evaluation
- ✓ Training
- ❑ Other: ________________________

What types of training and/or testing operations are conducted? (Select all that apply.)

- ❑ Air-to-air
- ❑ Air-to-land
- ❑ Air-to-water
- ❑ Airborne surface attack
- ✓ Amphibious warfare
- ❑ Anti-submarine warfare
- ❑ Electronic warfare
- ✓ Land-to-air
- ✓ Land-to-land
- ✓ Land-to-water
- ❑ Mine laying/countermeasures training
- ✓ Open burning/open detonation
- ✓ Small-arms training
- ❑ Special warfare
- ✓ Water-to-air
- ✓ Water-to-land
- ✓ Water-to-water
- ❑ Other: ________________________

Form 17a. Operational Range Site Model – Operational Component (continued)

What types of ordnance/military devices were used at this range? (Select all that apply.)

Live	Inert	Device	Live	Inert	Device
❑	❑	Ballistic missiles	✓	❑	Primers, detonators, fuzes, squibs
❑	❑	Bombs	❑	❑	Projected grenades
✓	❑	Bulk high explosives, demolition charges	✓	✓	Projectiles
✓	❑	Bulk propellant, propellant charges	✓	❑	Pyrotechnics (flares, signals, simulators)
✓	✓	Guided missiles	❑	❑	Rifle grenades
❑	❑	Cartridge Actuated Devices (CADs) and Propellant Actuated Devices (PADs)	❑	❑	Riot control agents
❑	❑	Chaff	✓	✓	Rockets
❑	❑	Depth charges	✓	✓	Small arms ammunition (.50 cal or under)
❑	❑	Hand grenades	✓	❑	Submunitions
❑	✓	Large rocket motors (> 1,000 lbs)	❑	❑	Torpedoes
❑	❑	Mines	✓	❑	Warheads
❑	❑	Mortars	❑	❑	Other:

What type of targets were used at this range? (Select all that apply.)

✓ Stationary

❑ Mobile

❑ None

❑ Unknown

If targets are/were used, please provide details including types and locations: *Steel plates, earthen berms, and concrete blocks*

Enclose a geographical map illustrating the following (check which apply):

✓ Range location

✓ Range boundaries

❑ Target locations

✓ Range areal extent, including the following:

✓ Counties ❑ Tribal reservations ✓ Independent cities/towns/States

Is this range, including the impact area, undergoing or has it undergone any type of investigation, cleanup, or response action for unexploded ordnance (UXO) or MCs?

✓ Yes (please elaborate) *As described in the IR Form, many sites where munitions were used previously have undergone investigation and restoration activities.*

No

Form 17b. Operational Range Site Model – Land Use Component

Who is the owner and who are other users of the range/Operational area (OPAREA)?		
Owner	**User**	
✓	❑	Navy (Identify): Commander, Naval Installations Command (CNIC) owns property and primary mission is managed by Naval Surface Warfare Systems Command (NAVSEA)
❑	❑	Other DoD component (Identify): ____________________
❑	❑	Other Federal agency (Identify): ______________________
✓	❑	State, city, or other municipality (Identify): State of Maryland is responsible for Potomac River
❑	❑	Tribe (Identify): ____
❑	❑	Commercial activity (Identify): ______________________________________
❑	❑	Private individual or organization (Identify): __________________________
		If Navy is not owner, when does lease, land withdrawal, or agreement to use land expire? __________________________

What are the current land uses? (Check on range/off range for all that apply.)					
On	**Off**	**Use**	**On**	**Off**	**Use**
❑	❑	None, no access authorized	✓	✓	Vehicle parking
❑	❑	Wildlife refuge	❑	❑	Surface supply storage
❑	❑	Livestock grazing	❑	✓	Commercial
❑	❑	Agriculture	❑	✓	Residential
✓	✓	Surface recreation	❑	✓	Construction
❑	✓	Subsurface recreation	❑	❑	Other _________________________

How is access controlled? (Select all that apply.)			
✓	Access key maintained by security/range officer	❑	Partial fencing
✓	Fencing around entire range/site	❑	Patrolled by aircraft
✓	Locked/secured gates	✓	Patrolled by Navy vessel
❑	Log-in book	✓	Patrolled by security officer or other official
❑	No controls	❑	Signs
		❑	Other: ____________

Form 17c. Operational Range Site Model – Environmental Component

List the predominant soil type (select one).	
❑ Clay-sand/clay-silt	✓ Sand-silt/sand-clay
❑ Clay/sand with stone	❑ Silt/silty clay
❑ Gravel/gravel-sand	❑ Water range/site
❑ Rock	❑ Other: ___________________________
❑ Sand/gravel-sand	

List the predominant topography.	
❑ Flat	❑ Mountainous
✓ Flat with gorges or gullies	❑ Rolling with gorges or gullies
❑ Gently rolling	✓ Water range/site
❑ Heavily rolling	❑ Other: ___________________________

List the predominant vegetation.	
❑ Barren or low grass	❑ Shrubs and some trees
✓ Heavy grass and many shrubs	✓ Heavily wooded
✓ Heavy shrubs and trees	✓ Water range/site
❑ Low grass and few shrubs	❑ Other: ___________________________

What is the depth to shallowest groundwater and bedrock?
Groundwater: 20-25 feet below ground surface
Bedrock: __________ feet below ground surface

Is the closest (i.e., shallowest) aquifer actually used as a drinking water or other type of source?	
Drinking Water	**Other (e.g., irrigation)**
❑ Yes	❑ Yes
✓ No	✓ No
❑ Unknown	❑ Unknown

Based on sampling data, estimate the level of surface or groundwater contamination as a result of range operations.		
❑ Non-detectable	❑ Minimal	✓ Moderate (some exceedances of standards)
❑ Significant	❑ No data available	❑ Unknown

Based on investigations or other data, estimate any adverse impacts on sensitive ecosystems as result of past operations conducted on this range.		
✓ Non-detectable	❑ Minimal	❑ Moderate
❑ Significant/substantial	❑ Samples not taken	❑ Unknown

Is there any information indicating the presence of any potential or known threatened/endangered species – flora and fauna – on this range?
✓ Yes
❑ No
❑ Unknown
If yes, identify species: Bald eagle

Based on investigations or other data, estimate any adverse impacts to natural resources as a result of past operations conducted on this range.		
❑ Non-detectable	✓ Minimal	❑ Moderate
❑ Significant/substantial	❑ No data available	❑ Unknown

Form 17c. Operational Range Site Model – Environmental Component (continued)

Estimate the potential for hazardous releases to the air as a result of past operations conducted on this range.		
❑ Non-detectable	✓ Minimal	❑ Moderate
❑ Significant/substantial	❑ No data available	❑ Unknown

Have any NEPA documents that address range operations been prepared?
Yes ❑ No ❑ Unknown If yes, please identify documents: ______________________________________

Form 18. Encroachment Review

Are there environmental restrictions on where training operations are performed?

- ❑ Avoidance areas: *The U.S. Fish and Wildlife Service and Virginia Department of Game and Inland Fisheries bald eagle protection guidelines include time of year restrictions. Impacts to range and construction activity are of concern as expansion of testing activities may be compromised. Avoidance areas on EEA for nesting hawks. Not presently debilitating to mission.*
- ❑ Rise in altitudes for flight training No current air to ground activity on ranges. *No local airports. Future Unmanned Aerial Vehicle (UAV) airfield operations may cause public concern.*
- ❑ Munitions and Explosives of Concern (MEC): *Unexploded Ordnance (UXO) and Discarded Military Munitions (DMM) resulting from historical testing conducted at Dahlgren is an encroachment both on the land-based range areas and to a lesser extent on the water range that extends 26 miles down the Potomac River. The presence of buried munitions on the Main Side and EEA range and non-range areas represents an encroachment by removing viable land areas from available range expansion inventories and poses a potential environmental risk where UXO or DMM are encountered in the subsurface or are exposed by erosion. Range areas potentially affected by MEC include areas on or surrounding the Missile Test Range, Terminal Range, and the Small Caliber/ Machine Gun Range. The Old Battery Plate Munitions Area is a land based munitions burial on the Missile Test Range that is encroaching on the shoreline area through bluff erosion.*

  Use of Navy sewer/water systems by non-Navy entities and the potential for problems associated with competition for potable water from deep aquifers is a potential encroachment issue correlative with population growth in the area. Potable water on the Base is produced from deep (800-900 feet BLS) wells and mission related impacts to the shallow (Columbia) aquifer have been documented. However, non-Navy usage of shallow groundwater off post has not been characterized. Population encroachment surrounding the Base may promote usage of the shallow groundwater with potential exposure consequences.

If yes, please specify:

If others, please specify: ______________________________________

Are there environmental restrictions on what training operations are performed?

- ❑ Weapons application: *Larger explosive tests have been conducted off site to reduce noise and vibrations associated with testing.*
- ❑ New technologies *The potential for future laser emitter interference created by Navy laser emitters or non-DOD sources is not causing a problem currently but has a potential to interfere with Naval Support Facility Dahlgren (NFSD emitting and receiving activity. Future Unmanned Aerial Vehicle (UAV) airfield operations may cause public concern.*

If yes, please specify: ______________________________________

If others, please specify:

Are there environmental restrictions on how training operations are performed?

- ❑ Frequency spectrum encroachment *The potential for RF transmitters outside the base, while not currently problematic, could impact NSFD emitting and receiving activity due to EM interferences. Antennas installed or planned at NSFD include a cell phone tower; dedicated antenna to connect Navy and local law enforcement and emergency responders; and two Enterprise Land Mobile Radio (ELMR) antennas.*
- ❑ Underwater noise constraints *N/A*
- ❑ Size constraints *Larger explosive tests have been conducted off site to reduce noise and vibrations associated with testing.*
- ❑ Additional duties assigned to personnel: *None noted.*
- ❑ Additional costs: *Potential range or range station relocation expenses associated with range station closures resulting from population growth in areas surrounding Dahlgren. Non-Navy control over leased range stations at NSFD has resulted in "termination of use" at two range stations in the recent past. Although the Navy determined these stations could be relocated with no impact to mission, ongoing negotiations and planning efforts at other range stations continue. Many existing property owners have leased their property to the Navy for many years and are familiar with the base activity, but as land is sold, new property owners may be reluctant to renew these leases potentially impacting future range operations.*

If yes, please specify: *Range operations have resulted in damage to personal property near the Base perimeter as setback (buffer) distances from the Navy property line are not in place. NSFD currently takes action to address testing impacts to the surrounding community. Sound meters are deployed along the river. Noise monitoring, meteorological measurements, and results from Sound Intensity Prediction System (SIPS) modeling are used to determine firing readiness. Predicted impact of noise >135-140 dB may results in a "No Shoot" decision.*

If others, please specify:

Form 18. Encroachment Review (continued)

Are there environmental restrictions on <u>when</u> training operations are performed?

- ❑ Available training days/times *Testing occurs M-F during normal business hours. No testing on weekends and rarely at night.*
- ❑ Night and all-weather training: *Noise monitoring, meteorological measurements, and results from Sound Intensity Prediction System (SIPS) model used to determine firing readiness. Predicted impact of noise >135-140 dB may results in a "No Shoot" decision. Short term delay to mission.*
- ❑ Reduction in flexibility/ increase in planning required to gain access: *The Navy receives complaints when range operations require that parts of the river be shut down and river traffic is diverted and controlled. Impacts to mission include short term delays and interruptions to allow boat traffic to pass. Boat traffic is anticipated to increase due to surrounding population increase. Explosive arcs that extend over waterways require the facility to deploy range boats to ensure that no river traffic is in an arc during a test.*

  Recreational marina development located along Dahlgren's river range and in proximity to the Main Side will result in greater water traffic leading to potential user conflicts.

If yes, please specify: ___________________________________

If others, please specify: ___________________________________

Are there environmental restrictions on how training operations are managed/overseen?

Additional management requirements: *Remedial actions associated with munitions-related site areas may require more extensive safety arc setback which could impact nearby admin offices, housing, critical research and development operations, and navigable waterways for extended periods of time, notably at Site 37. These actions could disrupt range operations over the period of implementation and require additional resource management and planning to either temporarily relocate or reschedule critical activities and minimize operational disruptions. Additional management of testing resources, scheduling, and location may be required to accommodate ecological restrictions associated with wildlife nesting or habitat particularly on the EEA. These restrictions are currently managed within the existing operational protocol at Dahlgren.*

Additional costs: *The additional costs of operational disruptions related to remedial action implementation are not definitively known and will depend on the requirements of the action.*

Permits: *Discharges from managed POL operations at NFSD are presently constrained by VPDES permitting. The POL functions and tank management are currently managed under the SPCC plan in place for the facility. These ongoing support activities are not restrictive to the ongoing testing mission.*

Property negotiations/agreements (e.g., buffer zones): *Interagency coordination: Non-Navy control over leased range support areas at Naval support Facility Dahlgren (NFSD) has resulted in "termination of use" of two range stations in the recent past. Although the Navy determined these ranges could be re-located with no impact to the mission, ongoing negotiations and planning efforts at other ranges continue. Many existing property owners have leased their property to the Navy for many years and are familiar with the base, however, as land is sold, new property owners may be reluctant to renew leases potentially impacting future range operations. The distribution of leased land will be delineated in the Encroachment Action Plan scheduled for completion in 2007. Dahlgren currently has:*

- *13 real estate leases*
- *one license*
- *one interagency agreement*
- *one memorandum of agreement with the State of Virginia*
- *one private agreement that supports range operations along the Potomac River*

Lease agreements for continued operation of the range stations are vital in supporting safe operations during ordnance testing. Each range station performs a function specific to the kind of programs conducted on the range (long range firings, aircraft and radar tests, etc.). All of the range station leases support the Main Range. Only other lease is located at Paramore Island and supports W Dept equipment testing. Currently, there are no other stations that are threatened by shutdown. Range Station 21 site was damaged by Hurricane Isabel and the Navy is in negotiations with NAVFAC and property owner to resolve repairs to this site. Shutdown costs are dependent on function of station with some stations being more vital than others. Personnel are not located at the leased stations. Range operations could be severely impacted if property owners do not renew existing real estate leases with the Navy.

Legal consul: *N/A*

Negotiations over regulations: *No current state involvement with encroachment issues. Development and implementation of Encroachment Action Plan may involve negotiations with local citizens groups and regulatory agencies.*

Public relations activities: *Encroachment Action Team meets monthly. Installation operates Internet site (http://www.nswc.navy.mil/) to promote public awareness of test firings and installation activities. Range Complex Management Plans (RCMP) will be produced for each Navy Range Complex. The RCMP process produces a detailed breakdown of each range's current ability to meet mission requirements. Each document gives a list of the specific warfare areas that a range is required to support. Based on detailed encroachment and capability/capacity analyses for each complex, the document then assigns a low, medium, or high risk rating by warfare area to the training currently available at the complex. The Navy is on schedule to complete RCMPs for all of its ranges worldwide by 2007. The Navy builds on the RCMP analysis by developing an Encroachment Action Plan (EAP). An EAP is the blue print for an installation or range's Encroachment Management program. The EAP identifies encroachment challenges that negatively impact military activities and documents the nature and degree of degradation of testing or training activities. The EAP also will assess the effectiveness of current Navy management, planning, or outreach activities to minimize negative mission impacts and associated additional costs. It examines regulatory and community frameworks that support or exacerbate encroachment challenges, while providing short-, mid-, and long-term strategies to address and correct or prevent the identified encroachment impacts. The Dahlgren Encroachment Action Plan is under development and scheduled for 2007 completion.*

THIS PAGE WAS INTENTIONALLY LEFT BLANK

APPENDIX D

ENVIRONMENTAL RESTORATION SITE MANAGEMENT PLAN AND DECISION DOCUMENT

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Environmental Restoration
Site Management Plan

July 2008
Naval Support Facility Dahlgren
Dahlgren, Virginia

NAVFAC
Naval Facilities Engineering Command
NAVFAC WASHINGTON

Naval Support Activity
SOUTH POTOMAC

TABLE OF CONTENTS

SECTION **PAGE**

LIST OF ACRONYMS .... **vii**

DEFINITIONS .... **xi**

1.0 INTRODUCTION **1-1**
1.1 FORMAT OF THE SITE MANAGEMENT PLAN 1-1
1.2 DESCRIPTION OF THE INSTALLATION 1-2
1.3 ENVIRONMENTAL HISTORY OF THE INSTALLATION 1-5
1.4 FEDERAL FACILITY AGREEMENT 1-6
1.5 PURPOSE OF THE SITE MANAGEMENT PLAN 1-7

2.0 APPENDIX A SITES **2-1**
2.1 IR SITES 2-5
SITE 2 - Fenced Ordnance Burial Area 2-5
SITE 3 - Ordnance Burn Structure 2-10
SITE 9 - Disposal/Burn Area 2-12
SITE 10 - Hideaway Pond 2-20
SITE 12 - Chemical Burn Area 2-22
SITE 17 - 1400 Area Landfill 2-27
SITE 19 - Transformer Draining Area 2-39
SITE 25 - Pesticide Rinse Area 2-40
SITE 29 - Battery Service Area 2-44
SITE 44 - Rocket Motor Pit 2-46
SITE 58 - Building 1350 Landfill 2-48
2.2 PRIORITY 1 SITES 2-49
SITE 6 - Terminal Range Airplane Park 2-49
SITE 21 - Gun Barrel Decoppering Area 2-52
SITE 22 - Gun Barrel Degreasing Area, North Main Range 2-53
SITE 31 - Airplane Park Dump, EEA 2-55
SITE 32 - Fast Cook-Off Pit and Pond, EEA 2-57
SITE 45 - July 28, 1992 Landfill B 2-59
SITE 46 - July 28, 1992 Landfill A: Stump Dump Road 2-60
SITE 50 - Fill Area Northeast EEA 2-63
SITE 51 - Battery Locker Acid Draining Area 2-65
SITE 53 - OWS 207-300 2-66
SITE 55 - Cooling Pond 2-66
2.3 PRIORITY 2 SITES 2-69
SITE 13 - Gambo Creek Truck Wash Area 2-69
SITE 20 - Former Electroplating Waste UST 2-71
SITE 23 - Building 480 Lot (PCB Storage) 2-75
SITE 37 - Lead Contamination Area 2-77
SITE 56 - Gun Barrel Degreasing Area, Railway Spur 2-81
SITE 57- Shell House Dump 2-83

TABLE OF CONTENTS (Continued)

SECTION **PAGE**

2.4 PRIORITY 3 SITES 2-85
SITE 4 - Case Storage Area 2-85
SITE 14 - CW Evaporation Pond 2-87
SITE 15 - Scrap Area 2-90
SITE 38 - Building 1349 Pest Control Outside Area 2-92
SITE 40 - Building 120B DRMO Lot 2-93
SITE 43 - Higley Road Land Application Area 2-94
SITE 61a - Gambo Creek Ash Dump 2-95
SITE 62 - Building 396 2-97
2.5 PRIORITY 4 SITES 2-99
SITE 1 - Old Bombing Range and SITE 5 – Projectile Disposal Area 2-99
SITE 36 - Depleted Uranium Mound, Pumpkin Neck 2-100
SITE 47a - W.W.I Munitions Mound 2-102
SITE 47b - EOD Scrap Area 2-103
SITE 49 - Depleted Uranium Gun Butt 2-104

3.0 APPENDIX B SITES 3-1
SWMU 3 - Building 194AA (Concrete Pad) 3-1
SWMU 15 - Building 120B Contractor Staging Area 3-4
SWMU 20/Site 41 - Compost Area 3-5
SWMU 23 - Building 456 Oil Waste Drum 3-6
SWMU 27 - Tank 280 Contractor Staging Area 3-7
SWMU 57/Site 60 - Building 445 Star Gauge Loading Dock 3-7
SWMU 61 - Paint Can Crusher 3-8
SWMU 62 - Paint Can Dumpster 3-9
SWMU 64 - Building 448 Sandblast Area 3-10
SWMU 67 - Building 448 Tar Tank Area 3-10
SWMU 70 - Building 152 TRICHLOROETHANE ACCUMULATION AREA 3-11
SWMU 77 - Building 1329 Wash Area 3-12
SWMU 78 - Building 1121 Former Waste Oil UST 3-13
SWMU 82 - Electroplating Line and WWT 3-14
SWMU 101 - Building 155 Auto Shop Waste Oil Filter and UST 3-15
SWMU 115 - Building 1282 Auto Hobby Outside Used Oil Storage 3-17
SWMU 119 - Building 1282 Auto Hobby Used Oil Tank 3-17
SWMU 125/Site 52 - OWS 107-350 (Yardcraft Area) 3-18
SWMU 127 - OWS1121-300, OWS115-350, OWS402-30,000, and OWS486-1000 3-18
SWMU 128/Site 54 - OWS 1121-Old 3-19
SWMU 130/Site 28 - Yardcraft Oil Storage Area 3-20
SWMU 131/Site 28 - Gambo Creek Compost Area 3-21
AOC A - Otto Fuel Spill (IAS Site 33) 3-21
AOC O - Building 1369 Pesticide Spill Area 3-22
AOC X - Classified Documents Incinerator Sewage Holding Tank (IAS Site 18) 3-23
AOC X7/Site 39 - Open Storage Area Main Battery (Staining) 3-24
AOC Z - Terminal Range Building 109 3-25
Other Units C3 - Scar at Phalanx Test Area 3-25
Other Units C6 - Former Radio Testing Area 3-26
Additional Areas X6 - South Hangar Former Tank Area 3-26
SITE 59 - Octagon Pad Dump, EEA 3-27
Building 126 - Former Powder Magazine 3-28
Site 61b - Gambo Creek Projectile Disposal Area 3-28
Building 198 - Neutralization Tank 3-30

TABLE OF CONTENTS (Continued)

SECTION **PAGE**

4.0 FACILITY-WIDE ACTIVITIES 4-1
4.1 Gambo Creek Ecological Assessment.. 4-1
4.2 Community Involvement Plan 4-2
4.3 Perchlorate Decision Making 4-3

5.0 SITE MANAGEMENT SCHEDULES.. 5-1

6.0 SITE NAME CROSS REFERENCE 6-1

REFERENCES.. R-1

APPENDIX A: SITE SCHEDULES

APPENDIX B: DRAWINGS

TABLES

NUMBER **PAGE**

2-1 Appendix A Sites Grouped by Priorities....2-2
2-2 Site 12 Groundwater Treatment Milestones 2-28
2-3 Site 17 Methane Results .... ………….... 2-38
2-4 Site 25 Remedial Action Objectives....2-43
3-1 Appendix B Sites... 3-2
4-1 Perchlorate Evaluation Table....4-7
5-1 Appendix A Site Management Schedule 5-2
6-1 Site Name/Number Cross Reference List....6-1

FIGURES

NUMBER **PAGE**

1-1 Facility Location Map 1-3
1-2 Site Location Map 1-5
4-1 Perchlorate Decision Tree 4-5

Drawing 1 Location of Units at Mainside....Appendix B
Drawing 2 Location of Units at EEA ....Appendix B

LIST OF ACRONYMS

AA	Accumulation Area
AOC	Area of Concern
ARAR	Applicable and Relevant and Appropriate Requirements
AS/SVE	Air Sparging/Soil Vapor Extraction
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
BTAG	Biological Technical Assistance Group
BTEX	Benzene toluene ethylbenzene xylenes
CAD	Cartridge Activated Devices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CO_2	Carbon Dioxide
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
CW	Chemical Warfare
CY	cubic yard
DCA	Dichloroethane
DCE	Dichloroethene
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenylethane
DDT	Dichlorodiphenyltrichloroethane
DIRT	Dahlgren Installation Restoration Team
DNAPL	dense non-aqueous phase liquid
DNT	Dinitrotoluene
DRMO	Defense Utilization and Marketing Office
DRO	Diesel Range Organics
DU	Depleted Uranium
EA	exposure area
EC	effects concentration
EE/CA	Engineering Evaluation Cost Analysis
EEA	Explosive Experimental Area
EM	electro-magnetic
EOD	Explosives Ordnance Disposal
EPA	Environmental Protection Agency

EPIC	Environmental Photographic Interpretation Center
ERN	Environmental Restoration Navy
ESD	Explanation of Significant Differences
ESS	Explosive Safety Submission
FFA	Federal Facility Agreement
FFS	Focused Feasibility Study
FS	Feasibility Study
FSSI	Field Support Services Inc.
ft	foot
ft^3	cubic feet
FY	fiscal year
GIS	Geographic Information Systems
GMP	Gas Monitoring Probe
GPS	Groundwater Protection Standards
GRO	Gasoline Range Organics
GW	groundwater
HQ	hazard quotient
HRC	hydrogen releasing compounds
HRS	Hazard Ranking System
IAS	Initial Assessment Study
IC	institutional controls
IR	Installation Restoration
IRP	Installation Restoration Program
JMWA	JM Waller Associates
kg	kilogram
LEL	Lower Explosive Limit
LTM	Long-Term Monitoring
LTV	Lower Threshold Value
LUCs	Land Use Controls
m	meter
MCL	Maximum Contaminant Level
MEC	Munitions and Explosives of Concern
mg	milligram
mm	millimeter
MNA	Monitored Natural Attenuation
MPPEH	materials potentially presenting an explosive hazard
MW	monitoring well

NAVFAC	Naval Facilities Engineering Command
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NSF Dahlgren	Naval Support Facility Dahlgren
NSWC	Naval Surface Warfare Center
NTU	Nephelometric Turbidity Unit
OB	Open Burning
O&M	Operations and Maintenance
ORS	Ordnance Related Scrap
OSWER	Office of Solid Waste and Emergency Response
OWS	Oil/Water Separator
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
pCi/g	pico curies/gram
phA-ER	phA-Environmental Restoration Corporation
PID	Photo-Ionization Detector
POC	Point of Compliance
ppm	Part Per Million
PRAP	Proposed Remedial Action Plan
PRGs	Preliminary Remediation Goals
PVC	Polyvinyl Chloride
RAO	Remedial Action Objective
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
RRL	Recommended Remediation Level
RSIP	Regional Shore Infrastructure Plan
SA	sampling area
SAR	Site Analysis Request
SARA	Superfund Amendments and Reauthorization Act
SAV	Submerged Aquatic Vegetation
SCS	SCS Engineers

Shaw	Shaw Environmental and Infrastructure
SMP	Site Management Plan
SSA	Site Screening Area
SSL	Soil Screening Levels
SSP	Site Screening Process
SVOCs	Semi-volatile organic compounds
SUXOS	Senior Unexploded Ordnance Supervisor
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCA	Trichloroethane
TCE	Trichloroethene
TCL	Target Compound List
TNT	trinitrotoluene
TOC	Total Organic Carbon
TOX	Total Organic Halide
TP	test pit
TPH	Total Petroleum Hydrocarbon
TSCA	Toxic Substances Control Act of 1978
TtNUS	Tetra Tech NUS, Inc.
U.S.	United States
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
UXO	Unexploded ordnance
VDEQ	Virginia Department of Environmental Quality
VOC	Volatile Organic Compound
VPDES	Virginia Pollution Discharge Elimination System
VSAP	Verification Sampling and Analysis Plan
VSI	Visual Site Inspection
WWT	Wastewater Treatment
µg/L	micrograms per liter

DEFINITIONS

Area of Concern (AOC) - Any suspected release of a hazardous waste or hazardous waste constituent which is not associated with a SWMU.

Parties - The U.S. Navy, USEPA, and the Commonwealth of Virginia.

Record of Decision (ROD) - A public document that selects and explains which cleanup alternatives will be implemented at NSF Dahlgren; includes the basis for the selection of the remedy.

Site Screening Area (SSA) - Those geographical areas listed in Appendix A of the FFA and any additional areas agreed to by the parties in the future. SSAs may be either RCRA SWMUs or AOCs or CERCLA AOCs. When the Parties agree, the SSAs may expand or contract in size as information becomes available indicating the extent of contamination and the geographical area needed to be studied.

Solid Waste Management Units (SWMUs) - Any discernable unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous wastes. Such units include any area at a facility where solid wastes have been routinely and systematically released.

1.0 INTRODUCTION

This report presents the Site Management Plan (SMP) for the Naval Support Facility Dahlgren (NSF Dahlgren) Dahlgren, Virginia. The purpose of the SMP is to document progress to date and present the planned activities to be conducted at NSF Dahlgren during fiscal years (FYs) 2008 and 2009. The SMP also provides projections for long-term progress at the installation in accordance with the Department of the Navy's Environmental Restoration Program and the Federal Facility Agreement (FFA) signed by U.S. Environmental Protection Agency (USEPA) Region III, Virginia Department of Environmental Quality (VDEQ) and the U.S. Navy. This report is updated annually in accordance with the FFA. This SMP has been prepared for the Naval Facilities Engineering Command, Washington, DC (NAVFAC Washington) and the NSF Dahlgren, Dahlgren, VA.

1.1 FORMAT OF THE SITE MANAGEMENT PLAN

The SMP is organized into eight sections, as described below:

Section 1.0 Introduction - This section presents a description and history of the installation.

Section 2.0 Appendix A Sites - This section describes the Appendix A sites of the FFA that require further action. These include the Installation Restoration (IR) sites, Priority 1 sites, Priority 2 sites, Priority 3 sites, and the Priority 4 sites.

Section 3.0 Appendix B Sites - This section describes sites that are identified in Appendix B of the FFA. The sites are screened to determine whether they belong in Appendix A.

Section 4.0 Facility-Wide Activities – This section presents summaries of activities that involve facility-wide programs, such as the Gambo Creek Ecological Assessment.

Section 5.0 Site Management Schedules - This section provides the estimated schedules and progress for conducting Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) activities for the Appendix A sites.

Section 6.0 Site Name/Number Cross Reference List – This section contains a cross-reference list for those sites that have name changes since the initial assessment.

References Includes all references consulted for the preparation of this SMP report.

Appendix A NORM Site Schedules

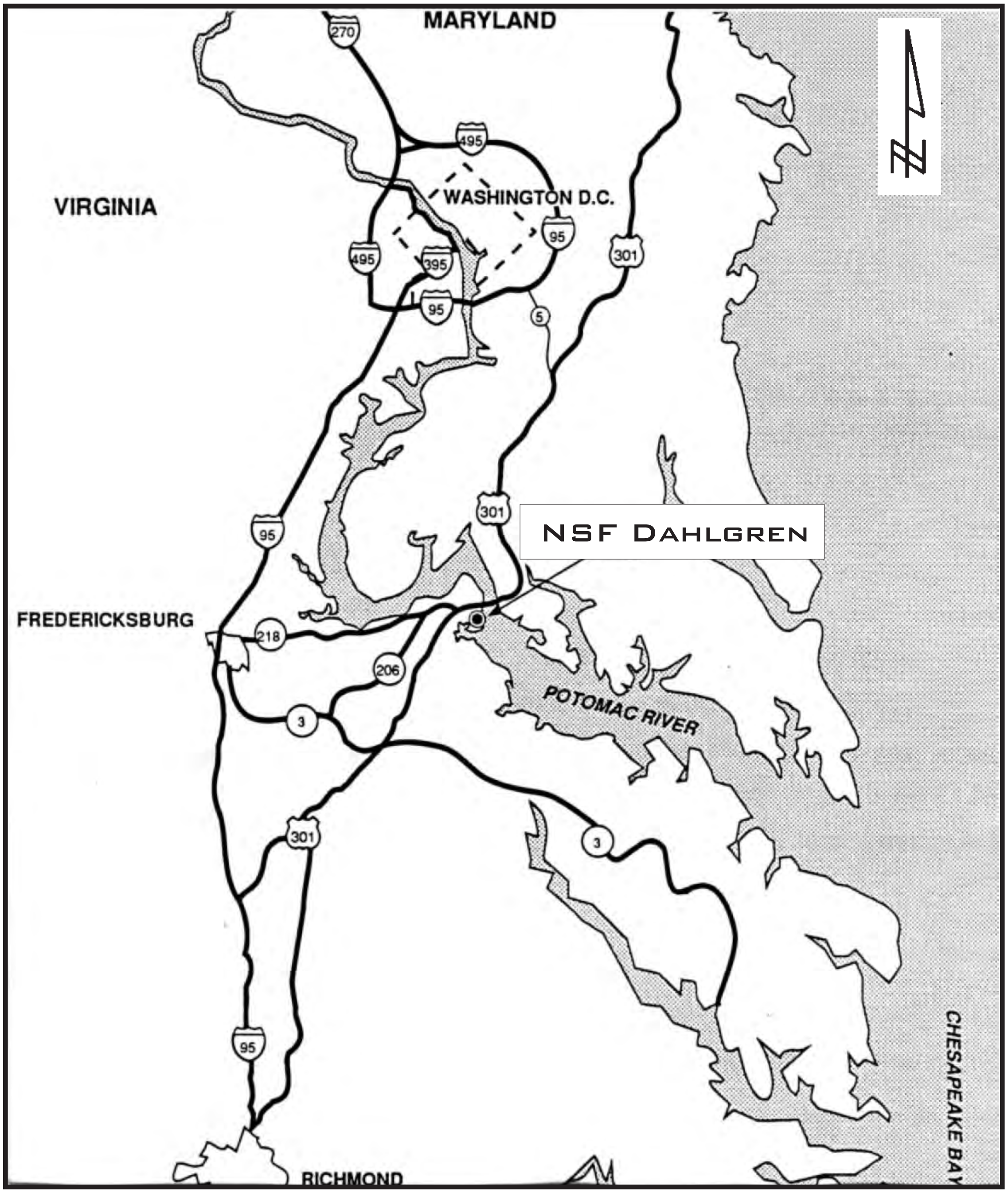
1.2 DESCRIPTION OF THE INSTALLATION

The NSF Dahlgren is located on the western shore of the Potomac River in King George County, Virginia, approximately 25 miles east of Fredericksburg, VA and 40 miles south of Washington, D.C. (Figure 1-1). The NSF Dahlgren is bounded on the north by U.S. Highway 301 and on the east by the Potomac River. Upper Machodoc Creek flows in a general west-to-east direction through the NSF Dahlgren, dividing it into two principal areas, the Mainside to the north, consisting of 2,678 acres, and the Explosive Experimental Area (EEA) to the south, consisting of 1,641 acres (Figure 1-2). The EEA, located on Tetotum Flats, is more commonly referred to as Pumpkin Neck. Gambo Creek flows in a general north-to-south direction through the Mainside (Figure 1-2).

Approximately 524 structures are located within the NSF Dahlgren boundaries. Facilities on the Mainside are used primarily for administration (e.g., public works, supply), research and development, housing, and community support activities. The Mainside also contains areas, such as an airfield and a security area, where a variety of ordnance materials are developed. The EEA is used exclusively for the testing of naval ordnance and includes static detonation arenas, drop test towers, static thrust stands, thermal test retaining cages, fast and slow cook-off facilities, shock test facilities, and high explosive vibration facilities.

Primary access to the NSF Dahlgren is via U.S. Highway 301, Virginia Route 206, and Virginia Route 614. Controlled access through perimeter fencing at Mainside is via two gated entrances, the Main Gate entrance, on Virginia Route 206, and the Gate B entrance, off U.S Highway 301. Access to the EEA, on Tetotum Flats, is through a gated entrance off Virginia Route 218 and is open only on request with proper authorization.

Approximately 40 percent of the Mainside is composed of residential/developed areas located on the southern portion of the site. The northern and western portions of the Mainside contain large blocks of forest. Developed areas comprise approximately 8 percent of the EEA. Over 60 percent of the EEA is hardwood and pine forest. Marshland is also common over portions of this area. Two large open field test areas are located in the central portion of the EEA.

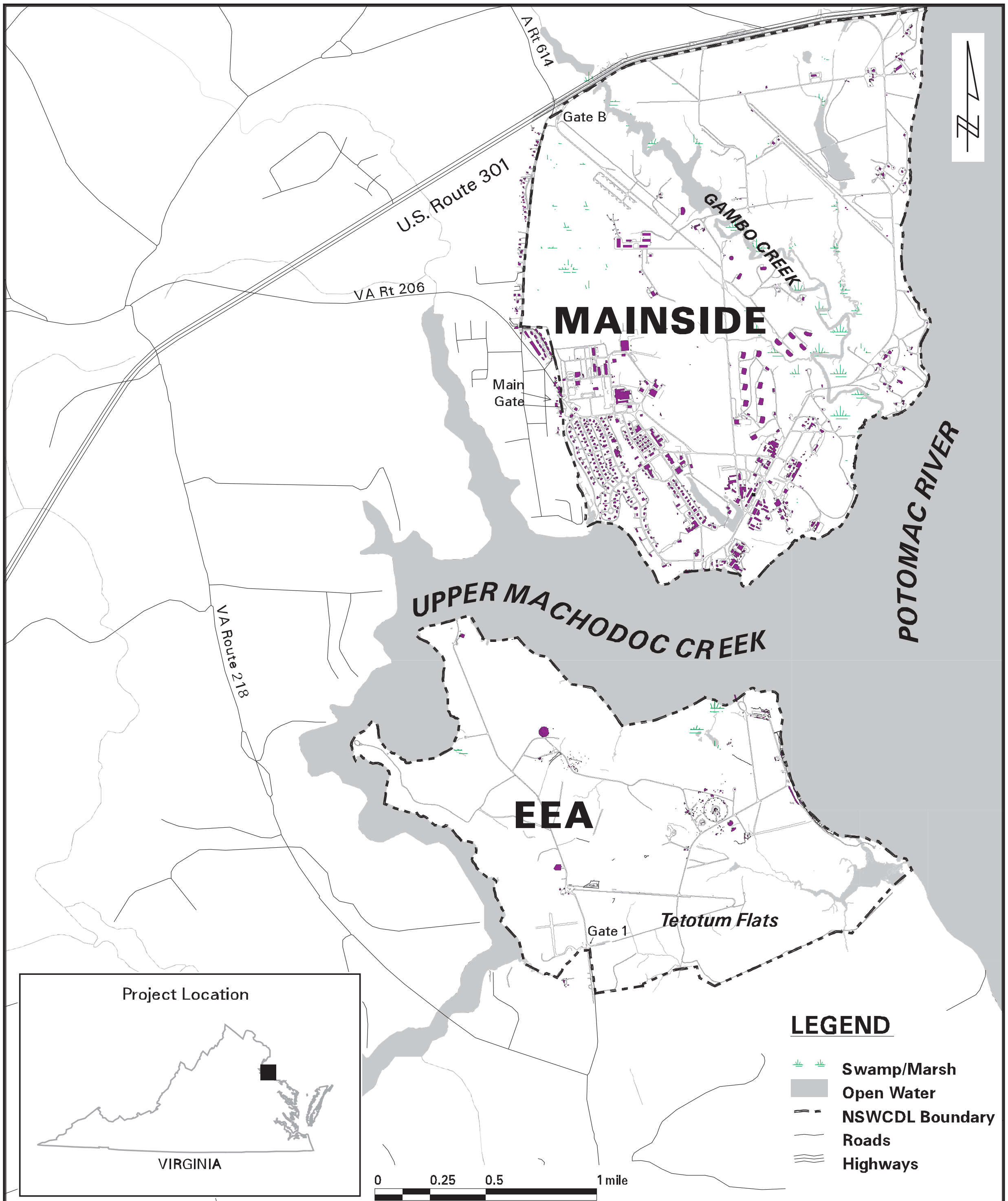


0 10 20
Scale in Miles

Source: NAVFAC, 1993

DRAWN BY JF	DATE June 2008	Tetra Tech NUS, Inc.	CONTRACT NO. N62477-03-D-0163	OWNER NO.
CHECKED BY	DATE	LOCATION MAP NAVAL SUPPORT FACILITY DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY	DATE
COST/SCHED-AREA			APPROVED BY	DATE
SCALE AS SHOWN			DRAWING NO. Figure 1 - 1	REV. 0

K:/GRAPHICS/dahlgren/dahlgren/basewide/location1.cdr



DRAWN BY LR / DATE June 08	Tetra Tech NUS, Inc	CONTRACT NO. N62477-03-D-0163	OWNER NO.
CHECKED BY / DATE	FACILITY LAYOUT NSF DAHLGREN DAHLGREN, VIRGINIA	APPROVED BY / DATE	
COST/SCHED-AREA		APPROVED BY / DATE	
SCALE AS SHOWN		DRAWING NO. Figure 1-2	REV. 0

K:\graphics\dahlgren\dahlgren\base-wide\#cto144_location3.cdr

The installation was established in 1918 with the primary mission of testing all naval ordnance materials. Since then, the mission of the NSF Dahlgren has evolved to research and development operations. At present, the installation is under the jurisdiction of the Naval Support Activity, South Potomac and hosts three principal tenant commands: the Naval Space Command, the Joint Warfare Analysis Command, and the AEGIS Training Center.

1.3 ENVIRONMENTAL HISTORY OF THE INSTALLATION

During the Initial Assessment Study (IAS) for the NSF Dahlgren, conducted during July 1981, thirty six potentially contaminated sites were identified (Fred C. Hart Associates, Inc., 1983). Among these potentially contaminated sites, the following were identified as requiring further investigation: Fenced Ordnance Burial Area (IAS Site 2), Disposal/Burn Site (IAS Site 9), Hideaway Pond (IAS Site 10), Chemical Burn Area (IAS Site 12), Transformer Draining Area (IAS Site 19), Pesticide Rinse Area (IAS Site 25), and Barbette/Depleted Uranium Contamination Area (IAS Site 34). The purpose of the IAS was to identify and assess sites posing a potential threat to human health or the environment due to contamination from past hazardous materials operations. The IAS recommendations were based on information from historical records, aerial photography, field inspections, and personnel interviews. Each of the sites was evaluated with regard to contamination characteristics, migration pathways, and pollutant receptors.

The IAS concluded “while none of the sites poses an immediate threat to human health or the environment, seven sites warrant further investigation under the Navy Installation Restoration Program to assess potential long-term impacts.” A Confirmation Study, involving sampling and monitoring of the seven sites, was recommended to identify the presence of suspected contamination, if any, and quantify the extent of any problems that may exist.

O’Brien & Gere (1986a) conducted confirmation studies during 1983 and 1984 at five of the seven IAS sites. The five IAS sites studied were Sites 9, 10, 12, 19, and 25. In addition, a confirmation study was performed at the 1400 Area Landfill (IAS Site 17) (presumably because of its possible connection with potential contamination at IAS Site 10). Preliminary sampling and analysis programs were conducted to attempt to confirm the presence or absence of suspected contaminants and to define any past or future migration of those contaminants. Due to the preliminary nature of the confirmation studies, only limited conclusions were possible, though the presence of contamination was indicated at all five sites.

Based on conclusions reached as part of the Confirmation Study, continued monitoring of groundwater was recommended at IAS Sites 9, 10, 12, 19, and 25. A groundwater monitoring plan (O’Brien & Gere, 1986b) was developed for these sites; however, it was not implemented at that time.

Since the completion of the Confirmation Study, the Navy concluded that eight sites should be included under the Navy's Installation Restoration Program (IRP) at the NSF Dahlgren. These included the Fenced Ordnance Burial Area (IAS Site 2), the Disposal/Burn Area (IAS Site 9), the Hideaway Pond (IAS Site 10), the Chemical Burn Area (IAS Site 12), the 1400 Area Landfill (IAS Site 17), the Transformer Draining Area (IAS Site 19), the Pesticide Rinse Area (IAS Site 25), and the Battery Service Area (IAS Site 29). IAS Site 2 was recommended for additional study in the IAS but was not included in the Confirmation Study. IAS Site 29 was added because it was determined that this site consisted of an unlined limestone pit rather than an underground storage tank. Information on the background and setting of the eight Remedial Investigation/Feasibility Study (RI/FS) sites is presented in Section 2.0.

The NSF Dahlgren installation was evaluated by the USEPA using the Hazard Ranking System (HRS), which assesses the potential hazards posed by contaminated sites (USEPA, 1991). The HRS evaluated and prioritized potential risks to human health and the environment resulting from past hazardous waste management practices at the NSF Dahlgren. The HRS score for the NSF Dahlgren was higher than the 28.5 needed to place the site on the National Priority List (NPL). The NSF Dahlgren was proposed for the NPL on February 7, 1992, and USEPA added it to the list on October 14, 1992.

Concurrent with the activities described above, USEPA initiated corrective action at the NSF Dahlgren. Pursuant to its Resource Conservation and Recovery Act (RCRA) Corrective Action Program, USEPA Region III conducted a visual site inspection (VSI) in August 1992. As a result, 129 solid waste management units (SWMUs), 26 areas of concern (AOCs), and 5 other units were identified. The IAS sites were also assigned a SWMU or AOC number. Subsequent to the VSI, USEPA determined that six additional units required further action based on an analysis of aerial photography. From this original list USEPA and the Navy determined that 75 sites required further investigation (USEPA, 1993). The sites are divided into two categories, Appendix A sites and Appendix B sites. Appendix A sites are identified in Sec. 2.0, Table 2-1. Appendix B sites are identified in Sec. 3.0, Table 3-1.

1.4 FEDERAL FACILITY AGREEMENT

On February 7, 1992, the USEPA proposed in 57 Federal Register 4824 through 4827, that the NSF Dahlgren be added to the NPL. On October 14, 1992, the NSF Dahlgren was finalized on the NPL. Following listing on the NPL, negotiations for a FFA between USEPA Region III, the Commonwealth of Virginia, and the Department of the Navy (hereafter referred to as the Parties) were initiated. The parties signed the FFA on September 30, 1994.

All the sites categorized in the FFA are listed in Table 2-1 (Appendix A sites) and Table 3-1 (Appendix B sites). The FFA categorized the sites either as those that will be further characterized (Appendix A of the FFA), or sites that require additional documentation or sampling (Appendix B) before no further action is warranted. Table 2-1 includes the current phase of each Appendix A Site as of June 15, 2008. Sites that will be further characterized (Appendix A sites) are classified as site screening areas (SSAs). SSAs include the geographical areas listed in Appendix A of the FFA and any additional areas agreed to by the parties in the future. The term SSA is defined in the list of definitions following the Table of Contents. Under the terms and conditions of the FFA, SSAs are required to be investigated and, if appropriate, remediated in accordance with the National Contingency Plan (NCP), CERCLA, Superfund Amendments and Reauthorization Act (SARA), and RCRA.

1.5 PURPOSE OF THE SITE MANAGEMENT PLAN

The SMP is one of the primary documents identified in the FFA. The SMP documents the decisions made during the project planning and scoping process for the NSF Dahlgren. The SMP includes proposed deadlines for completion of draft primary documents, as specified in the FFA, to be submitted during FYs 2008 and 2009 and proposed target dates for activities beyond the two-year planning period. A draft SMP was submitted to the parties 60 days after the FFA was signed and is revised no later than June 15 of each year thereafter. The SMP includes proposed actions for all CERCLA responses, specific RCRA corrective actions, and outlines all the response activities and associated documentation, under the FFA, to be undertaken at the installation.

2.0 APPENDIX A SITES

This section discusses the Appendix A Sites, which were identified in the FFA for NSF Dahlgren. Appendix A Sites are those that require further investigation. The Appendix A Sites were prioritized by a qualitative prioritization scheme which was developed informally by the parties. The prioritization scheme was based on the following criteria:

- Potential for groundwater contamination;
- Proximity to receptors;
- Contaminants verified as being present (including toxicity and migration potential);
- Potential for aquatic stress.

The original priority designation has changed for several sites based upon potential environmental risks, site development, sampling information, and professional judgment. The Appendix A sites have been divided into six categories: IR sites, Priority 1 sites, Priority 2 sites, Priority 3 sites, Priority 4 sites, and the Gambo Creek Ecological Assessment. Appendix A sites include IRP sites, SWMUs, AOCs, and other areas. The Appendix A sites are listed in Table 2-1 by priority designations and are delineated in Drawings 1 and 2, which are included in the back cover of this report. Drawing 1 shows the locations of the sites at Mainside and Drawing 2 shows the locations of the sites at the EEA. The terms SWMUs and AOCs are defined in the front of this document under definitions. The Appendix A “Site Numbers” have been changed to fit the chronological order numbering scheme previously developed by the Navy during the Initial Assessment Study, (Fred C. Hart Associates, Inc., 1983).

Personnel from the NSF Dahlgren, NAVFAC and Tetra Tech NUS (TtNUS) conducted a site visit on July 21 through July 23, 1993 (hereafter referred to as the Navy Site Visit) to gather additional information necessary for preparing the SMP. The purpose of the Navy Site Visit was two-fold: to verify USEPA's descriptions and to note any changes to the sites since USEPA's August 1992 VSI. Three additional SWMUs requiring additional action were identified from the Navy Site Visit. These SWMUs are: the Yardcraft Oil Storage Area (SWMU 130), the Gambo Creek Compost Area (SWMU 131), and the Gun Barrel Degreasing Area Railway Spur (SWMU 132).

TABLE 2-1

APPENDIX A SITES GROUPED BY PRIORITIES
NSF DAHLGREN
PAGE 1 OF 3

Site No.	Site Name	Current Status (as of June 15, 2008)
IR Sites		
Site 2	Fenced Ordnance Burial Area	ROD - Remedial Action Completed Long-Term Monitoring Underway
Site 3	Ordnance Burn Structure	Removal Action Completed ROD – No Further Action
Site 9	Disposal/Burn Area	ROD – Remedial Action Completed Long-Term Monitoring Underway Wetland Monitoring Underway
Site 10	Hideaway Pond	ROD - Long-Term Monitoring Underway
Site 12	Chemical Burn Area	ROD - Selected Remedial Action Completed ESD Completed Contingent Remedy Implementation Underway UFP-SAP VSAP in Review SAR Underway
Site 17	1400 Area Landfill	ROD - Remedial Action Completed Long-Term Monitoring Underway Wetland Monitoring Underway Methane Mitigation Trench in Planning
Site 19	Transformer Draining Area	Removal Action Completed ROD – No Further Action
Site 25	Pesticide Rinse Area	ROD – Remedial Action Completed Wetland Monitoring Underway
Site 29	Battery Service Area	Removal Action Completed ROD – No Further Action
Site 44	Rocket Motor Pit	Removal Action Completed ROD – No Further Action
Site 58	Building 1350 Landfill	ROD – Remedial Action Completed
Priority 1 Sites		
Site 6	Terminal Range Airplane Park	ROD – Remedial Action Completed Wetland Monitoring Underway
Site 21	Gun Barrel Decoppering Area	Removal Action Completed Decision Document – No Further Action
Site 22	Gun Barrel Degreasing Area, North Main Range	Removal Action Completed Decision Document – No Further Action
Site 31	Airplane Park Dump, EEA	Removal Action Completed ROD - No Further Action
Site 32	Fast Cook-off Pit and Pond, EEA	RI/FS Completed ROD - No Further Action
Site 45	July 28, 1992 Landfill B	Removal Action Completed Decision Document – No Further Action
Site 46	July 28, 1992 Landfill A: Stump Dump Road	ROD – Remedial Action Completed Wetland Monitoring Underway
Site 50	Fill Areas Northeast EEA	Removal Action Completed Decision Document – No Further Action Wetland Monitoring Underway

TABLE 2-1

APPENDIX A SITES GROUPED BY PRIORITIES
NSF DAHLGREN
PAGE 2 OF 3

Site No.	Site Name	Current Status (as of June 15, 2008)
Site 51	Battery Locker Acid Draining Area	SSP Completed – No Further Action
Site 53	OWS 207 300	Removal Action Completed Decision Document – No Further Action
Site 55	Cooling Pond	RI/FS Completed ROD - No Further Action
Priority 2 Sites		
Site 13	Gambo Creek Truck Wash Area	Removal Action Completed Decision Document – No Further Action
Site 20	Former Electroplating Waste UST	FFS Completed ROD Completed Soil Remedial Action Complete Groundwater Remedial Action Workplans underway
Site 23	Building 480 Lot (PCB Storage)	FFS Completed ROD Completed Soil Remedial Action Complete
Site 37	Lead Contamination Area	ROD Amendment Completed Remedial Action Completed
Site 56	Gun Barrel Degreasing Area, Railway Spur	SSP Completed Decision Document – No Further Action
Site 57	Shell House Dump	SSP Underway
Priority 3 Sites		
Site 4	Case Storage Area	EE/CA Completed VSAP Completed ESS and SAR in Review Removal Action Pending
Site 14	CW Evaporation Pond	EE/CA Completed VSAP in Review ESS and SAR in Review Removal Action Pending
Site 15	Scrap Area	EE/CA Completed VSAP Completed ESS and SAR in Review Removal Action Pending
Site 38	Building 1349 Pest Control Outside Area	SSP Completed Decision Document – No Further Action
Site 40	Building 120B DRMO Lot	SSP Completed Decision Document – No Further Action
Site 43	Higley Road Land Application Area	Removal Action Completed Decision Document – No Further Action
Site 61a	Gambo Creek Ash Dump	FFS Underway
Site 62	Building 396	RI/FS Completed Removal Action Completed ROD – No Further Action

TABLE 2-2

**APPENDIX A SITES GROUPED BY PRIORITIES
NSF DAHLGREN
PAGE 3 OF 3**

Site No.	Site Name	Current Status (as of June 15, 2008)
Priority 4 Sites		
Site 1 *	Old Bombing Range	Decision Document – Action is deferred until the range is closed or transferred.
Site 5 *	Projectile Disposal Area	Decision Document – Action is deferred until the range is closed or transferred.
Site 36	Depleted Uranium Mound, Pumpkin Neck, EEA	Removal Action Completed ROD – No Further Action
Site 47a	WWI Munitions Mound	EE/CA Completed Removal Action Completed Decision Document – No Further Action
Site 47b	EOD Scrap Area	EE/CA Completed Removal Action Completed Decision Document – No Further Action
Site 49	Depleted Uranium Gun Butt	Removal Action Completed ROD – No Further Action

* Sites removed from ER,N program funding.

In 1994, two additional sites were identified by the Navy, the Shell House Dump (SWMU 133) and the Building 1350 Landfill (Site 58). USEPA also identified an additional area in 1994, the Octagon Pad Dump (SWMU 135). In 1997, the Navy identified two additional sites, the Gambo Creek Ash Dump (Site 61a) and Building 396 (Site 62). In 2000, the Navy identified one additional site from field surveys, the Gambo Creek Projectile Disposal Area (Site 61b).

In 2001, the Navy reopened Site 4, Case Storage Area, and Site 15, Scrap Area, due to waste visually confirmed on the sites. In 2002, the Navy (with USEPA Region III and VDEQ concurrence) transferred the investigation and potential cleanup requirements of Site 47b, Explosives Ordnance Disposal (EOD) Scrap Area, from a cleanup governed by RCRA to a cleanup governed by CERCLA. In May 2003, the Navy, USEPA Region III, and VDEQ agreed to transfer Site 61b, Gambo Creek Projectile Disposal Area, from an Appendix A to an Appendix B site based on the trenching data evaluated by the Dahlgren Installation Restoration Team (DIRT) during the April 30, 2003 meeting. In 2006, an additional site (Building 198 Neutralization Tank) was identified during remediation activities at a nearby site.

2.1 IR SITES

There are eleven sites at the NSF Dahlgren that are part of the IR Program. The descriptions are based on information contained in the IAS (Fred C. Hart Associates, Inc., 1983), and the Confirmation Study (O'Brien & Gere, 1986a).

SITE 2 - Fenced Ordnance Burial Area

The Fenced Ordnance Burial Area (known as USEPA SWMU 46) is located in the northern portion of the Mainside area, close to the north shore of Gambo Creek. Access to Site 2 is from Gum Alley, which forms the northern perimeter of the site. Analysis of historical aerial photographs indicates that several trenches and burial pits were present within the site from the 1940s to the 1970s. Surficial soils across the site were also modified at various times dating back to the 1940s.

The IAS reports that a landfill was operational at this location in or around 1970 for the purpose of disposing of metal ordnance materials that may have contained explosives residues (Fred C. Hart Associates, Inc., 1983). These metals could not be verified as safe to recycle through normal scrap metal recycling procedures. In addition, empty pesticide containers and asbestos pipe wrappings have been buried at the site. Several trenches in this area contained ordnance hardware and machine parts. Several trenches south of the fenced area received aircraft scrap and non-explosive missile materials. An additional trench west of the fenced area received primarily mercury-lithium and silver-cell batteries.

Misch metal containing radioactive thorium may have been buried at this site. Misch metal, composed of thorium and rare earth metals alloyed with magnesium or nickel, was tested at the NSF Dahlgren for use in incendiary weapons. The misch metal is believed to contain approximately two percent thorium by weight and, as such, is exempt from U.S. Nuclear Regulatory Commission (NRC) licensing regulations.

The IAS also suggests that other items may have been disposed of at this location in the past. An unknown quantity of "cut up gun barrels" and small arms ammunition determined to be unusable were burned; the remaining material was determined safe for disposal as scrap metal or was reportedly buried (since 1970) within the Fenced Ordnance Burial Area.

Known and suspected contaminants of concern at the Fenced Ordnance Burial Area include residual low-level radioactivity, heavy metals, pesticides, polychlorinated biphenyls (PCBs), solvents, explosives, asbestos, and semi volatile organic compounds (SVOCs). No confirmation studies have been conducted at this site.

RI field activities included a geophysical and ground-surface radiological characterization of the site. Field activities also included groundwater sampling of new and existing monitoring wells, surface water and sediment sampling, and soil sampling. The Draft RI report was submitted in September 1995.

After results of the Draft RI were reviewed, it was determined that additional data would be needed to fill data gaps from this investigation (B&R Environmental, 1995). Therefore, a continuation of field activities was conducted between June 6, 1996 and January 8, 1997. Two additional wells were installed to better determine groundwater contamination. Surface soil, subsurface soil, and surface water samples were taken. Test pits were excavated to characterize the wastes in the western and southern trenches.

Slightly elevated concentrations of inorganic compounds were detected in each medium sampled, and buried metals disposed of at Site 2 are the likely source of these compounds. Based on the risk assessments, however, none of the levels detected for inorganic constituents pose a risk, with the exception of antimony. Volatile organic compounds (VOCs) and SVOCs were detected infrequently and in isolated locations. The concentration levels for both VOCs and SVOCs (including styrene and polynuclear aromatic hydrocarbons PAHs)) were well below the USEPA Region III risk-based contaminant of concern (COC) screening levels for these compounds.

The human health risk assessment indicated no potential health hazards were associated with Site 2. The ecological risk assessment concluded that the concentrations of antimony in surface soils, pesticides and a herbicide in sediments, and copper in surface water may pose unacceptable risks to ecological receptors. Potential remedial actions to address existing sediment contamination and contributions from other sources were evaluated as part of the Phase II Gambo Creek Ecological Assessment and no further actions were deemed to be necessary.

The Remedial Investigation was completed in July 1997. A Feasibility Study (FS) was prepared to provide remedial action alternatives for Site 2. Technologies and process options were evaluated and screened to develop remedial alternatives and the FS was completed in July 1997. A Proposed Remedial Action Plan (PRAP) was prepared and included the following alternative: remove soils exceeding remediation goals; remove western and southern trenches and debris piles; backfill with clean fill; consolidate all removed wastes onsite, dispose of recyclable materials from debris piles offsite; install a RCRA Subtitle C cap over waste and consolidated soils and implement institutional controls within the site boundaries. A PRAP and public notice were issued announcing the public comment period starting July 30, 1997 and ending August 29, 1997. No comments were received during the 30-day public comment period or at the Public Meeting held on August 6, 1997. In September 1997, the Navy and USEPA signed a Record of Decision (ROD) (TtNUS, 1997) and VDEQ issued a concurrence letter. The selected remedial alternative design was finalized in September 1997. Construction started in April 1998 and was completed in October 1998. During construction, additional ordnance and metal debris was found at the southwestern portion of the landfill area, thus, enlarging the cap approximately 15 percent from the original design. A Final Post-Remedial Action Report was submitted in June 2000 by OHM Remediation Services, which documents oversight and post-removal verification sampling and analysis conducted by TtNUS during the construction process.

Institutional control measures are underway to address site and land-use restrictions. A Long-Term Monitoring Plan was submitted in June 2003. The plan was then revised and resubmitted in September 2006. To date, seven rounds of groundwater monitoring have been performed: November 2001, January 2003, October 2003, July 2004, March 2005, June 2006, and September 2007. For the first three rounds, no detected constituents exceeded the Preliminary Remediation Goals (PRGs) identified in the Site 2 ROD, site-specific Groundwater Protection Standards (GPS), or Federal Maximum Contaminant Levels (MCLs). In the fourth round nickel, which was detected at 13.46 micrograms per liter (µg/L), was the only constituent that exceeded the GPS of 10 µg/L. Perchlorate analysis was also performed on the groundwater monitoring samples collected at Site 2 in 2003. Using a detection limit of 4 µg/L, no perchlorate was detected.

In accordance with Appendix 5.4 of the Virginia Solid Waste Regulations, a variance analysis was performed on groundwater sampling rounds 1 through 5 to identify whether statistically significant contamination above background is evident (TtNUS, 2005b). In the first five rounds of groundwater data, calcium (total and filtered), manganese, iron, and total organic carbon (TOC) concentrations were identified as statistically significantly above background. In addition, total aluminum, copper and manganese were identified as statistically significantly above background. Of these constituents, the iron, aluminum, and copper concentrations exceeded the Biological Technical Assistance Group (BTAG), GPS or background concentrations. However, the copper and manganese concentrations are below the ROD-specified PRGs, and currently there are no ROD-specified PRGs for aluminum, calcium, and iron. Based on this variance analysis, it was decided to continue groundwater monitoring at Site 2 at 15-month intervals.

In January 2006, the DIRT discussed the historical groundwater results and agreed that overall, the COCs were decreasing with time and the remedy was working. The only issue was the turbidity of the wells and it was agreed that the solution was to redevelop all the monitoring wells. Based on the continued presence of metals above background concentrations, groundwater monitoring would continue at 15 month intervals throughout the post-closure period.

Groundwater at Site 2 was monitored during Round 6 in June 2006. Two weeks prior to Round 6 groundwater monitoring, all five wells were redeveloped to reduce turbidity in groundwater as per the DIRT recommendations. Groundwater purging and sampling activities were then conducted on June 13 and 14, 2006 with the results being screened against background concentrations, PRGs, GPS, RAOs, and MCLs. The results indicated that 22 metals, TOC, and Total Organic Halide (TOX) were detected in the groundwater samples; however, all detected concentrations were lower than the Remedial Action Objectives (RAOs), PRGs, GPSs, and MCLs (TtNUS, 2006e).

Round 7 of groundwater monitoring activities took place in September 2007. The monitoring wells were redeveloped two weeks prior to the sampling event to reduce turbidity in the groundwater. Groundwater purging and sampling activities were conducted on September 12 and 13, 2007. The results were screened against background concentrations. Results indicated 22 metals, TOC and perchlorate were detected in one or more of the Site 2 monitoring wells. However, detected concentrations were below the RAOs, PRGs, GPS, and MCLs (TtNUS, 2007d). The next round of groundwater sampling is scheduled for January 2009.

Periodic monitoring of the surface water and sediment was conducted in September 2002 at two locations. One phthalate compound and 11 inorganic constituents were detected in the two surface water samples. Four phthalate compounds, eight PAHs, and 17 inorganic constituents were detected in two sediment samples. Pesticides were not detected in the surface water or sediment samples (TtNUS, 2003a).

A second round of surface water and sediment samples were collected in November 2004. No organics were detected in the surface water samples. Seventeen inorganics were detected in the surface water samples. Only aluminum, nickel, and silver exceeded the Federal Ambient Water Quality Criteria (AWQC). Three pesticides and twenty inorganics were detected in the sediment samples. No surface water or sediment PRGs were developed for pesticides. None of the metals exceeded the contaminants' historical maximum concentrations (TtNUS, 2005e).

A third round of surface water and sediment samples were collected in October 2006. Samples were collected from the same two collocated surface water and sediment sample locations within Gambo Creek in the vicinity of Site 2. Caprolactam was the only SVOC detected in surface water and there is currently no AWQC associated with caprolactam. No pesticides or PCBs were detected in the surface water samples. Twelve metals were detected in the two surface water samples; only aluminum and iron exceeded the AWQC, but at concentrations that were less than the midpoint of the historical concentration range for both constituents. No SVOCs were detected in the sediment samples. Three pesticides and one PCB were detected in the sediment samples, but no PRGs have been developed for sediment at Site 2. Twenty metals were detected in the two sediment samples, and except for aluminum, copper, and zinc, the detected metals concentrations were less than the midpoint of the historical concentration range (TtNUS, 2007a). The next round of surface water and sediment sampling is scheduled for January 2009.

The first Five-Year Review of Site 2 was conducted in April 2003 with a final report completed in September 2003 (TtNUS, 2003i). The final report indicated that the Site 2 remedy is functioning as designed and is protective of human health and the environment. Several issues, including the delay in implementing several administrative institutional controls, the lack of a formal operation and maintenance plan, and the delay in implementing a groundwater monitoring program, have been identified and have been addressed by the Navy. The next Five-Year Review is scheduled to be conducted in September 2008 with a final report to be completed in January 2009.

A Landfill Operations and Maintenance (O&M) Manual that includes Site 2 was prepared in May 2004 by JM Waller Associates (JMWA, 2004b) and has been presented to the Navy for their use. The O&M Manual addresses all landfill inspection items to check during both periodic and storm event inspections. The VDEQ inspection checklist is included in the manual to aid in performing the annual inspection. Maintenance requirements including mowing of vegetation and maintenance of site drainage structures, fences, and monitoring wells are discussed in the O&M Manual. A Landfill inspection was performed by VDEQ on December 2, 2004 and it was recommended that all landfills, including the one at Site 2, be monitored annually for methane. As a result, methane monitoring was performed in January 2006. Methane was detected at two groundwater locations (GW2-3 and GW2-6). Concentrations at these locations were less than 100 percent of the Lower Explosive Limit (LEL) of methane. A second landfill inspection was performed on March 20, 2006 and no major issues were identified at that time. The second round of methane monitoring at Site 2 was performed in November 2006 and no methane was detected. The most recent landfill inspection was conducted on December 18, 2007, by VDEQ, and no major issues were identified. Methane monitoring was conducted in June 2007. Methane and hydrogen sulfide were not detected in the wells at Site 2. The next methane monitoring event is scheduled for June 2008.

SITE 3 - Ordnance Burn Structure

The Ordnance Burn Structure (known as USEPA SWMU 42) is located in the Powder Burn Area in the central part of Mainside. This site is an open field, approximately 0.2 acres in size. A metal box and a burn pan were located at the site to support operations but have since been removed. This site began operation in the 1960s and was closed in September 1994. The site was approximately 6 feet long by 6 feet wide and 4.5 feet high on a gravel base. Site 3 also includes a popping furnace structure, located east of the burn areas. The popping furnace structure consists of a trench with concrete block sidewalls and a gravel floor. Dimensions of the trench are approximately 35 feet long, 10 feet wide and 2 feet deep. The popping furnace was reportedly used on only one or two occasions. Although the NSF Dahlgren applied for a RCRA permit to operate the site, the site operated under interim status until September 1994 when it was closed. The operation was moved with the same RCRA status to the EEA in September 1994.

Operations at Site 3 consisted of thermally treating explosive or explosive-contaminated waste in burn pans, in a steel box, in the popping furnace structure, or on the ground surface. Wastes burned at Site 3 may have included RCRA-listed hazardous wastes and characteristic reactive wastes. No estimate of the total quantity of material treated at this site has been prepared. The wastes may have included the following:

- Wastewater treatment sludge from the processing of explosives,
- Spent carbon from the treatment of wastewater containing explosives,
- Rocket motors,
- Explosive powder, and
- Other ordnance-related items.

The open burning (OB) unit at Site 3 was closed in a manner that eliminates the need for post-closure care. An Engineering Evaluation/Cost Analysis (EE/CA), issued in May 1998, contains closure plan requirements designed to achieve clean closure performance standards described in Virginia Regulation, 9VAC-20-60-580B. As part of the final design for this removal action, an investigation of contamination at the site was conducted in 1997. Limited organic and inorganic contamination was identified during the investigation. Inorganic concentrations above USEPA Region III Risk Based Concentration (RBC) levels included arsenic, iron, aluminum, nickel, manganese, chromium, and vanadium. Limited organic contamination was identified, including dioxins, semi-volatile organic compounds, and explosives but no organic compounds were detected above their respective RBCs (B&R Environmental, 1998a). The EE/CA was available for public comment in May 1998. The removal action was initiated in June 1998. A Remedial Investigation/Focused Feasibility Study (RI/FFS) was prepared for the combined Sites 3 and 44 because the sites are located close together and were used to perform similar types of operations. A rough draft statistical evaluation of the sampling information was submitted to the Commonwealth of Virginia for review in February 1999 and a final statistical analysis report of the verification sampling results for Site 3 and Site 44 was submitted in June 1999. Based on the statistical analysis of the verification sample results, soils at Site 3 and Site 44 were proposed to be “clean closed” regardless of future land use. Sites 3 and 44 were combined because the sites are located close together and were used to perform similar types of operations.

A groundwater monitoring plan was initiated to address any potential groundwater contamination. Quarterly groundwater sampling was conducted to meet Virginia Hazardous Waste Management Regulations. A total of four quarters of monitoring is required to establish background levels for comparison with point of compliance wells. The first quarter sampling was conducted in August 1996, the second quarter in November 1996, the third quarter in October 1997, and the fourth quarter in March 1998. An Annual Groundwater Report was submitted in November 1998 which summarized the quarterly results and reviewed the statistical significance of the data. The following items were noted in the Annual Report, comparing statistically significant constituents with MCLs and RBCs for drinking water.

- When comparing the maximum detected concentration of statistically significant constituents with MCLs, cadmium was the only constituent that exceeded the MCL. However, cadmium’s concentration was less than its RBC.

- When comparing the maximum detected concentration of statistically significant constituents with RBCs; RDX, arsenic, gross alpha, and gross beta were the only constituents that exceeded the RBCs. However, for each of these constituents except RDX, the concentrations were less than the MCL.

- The only statistically significant constituents that did not have a MCL or RBC were 2-amino-4,4-dinitrotoluene and 4-amino-2,6-dinitrotoluene.

The Commonwealth of Virginia reviewed this report for corrective action requirements. The RI/FFS was performed to assess residual risk following the removal action and groundwater monitoring. In addition, it provided the RCRA closure plan for groundwater at Site 3 and Site 44. The U.S. Navy, USEPA Region III, and VDEQ finalized the RI/FFS in July 2000 (TtNUS, 2000a). This report indicated that “no further action” was warranted for soils. The human health risk assessment for exposure to groundwater indicated risks are unacceptable. However, Sites 3 and 44 are not considered to be the source of groundwater contaminants of concern, which are: 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethene (1,1-DCE), and arsenic. 1,1-DCE and 1,1,1-TCA concentrations in downgradient wells were less than concentrations detected in upgradient wells. Site 12, nearby, has been identified as the source of these contaminants and is currently being remediated. Arsenic concentrations in downgradient wells were slightly less than concentrations detected in upgradient wells. An evaluation of these arsenic concentrations indicated that these levels are attributable to naturally occurring conditions.

A PRAP was prepared for Site 3 and Site 44 recommending no further action be taken at this site (U.S. Navy, 2000a). The PRAP and a public notice were issued announcing the public comment period starting July 20, 2000 and ending August 19, 2000. No comments were received during the 30-day public comment period or at the Public Meeting held on August 9, 2000. The Navy and USEPA signed a ROD documenting no further action in September 2000 and VDEQ issued a concurrence letter (U.S. Navy, 2000c).

SITE 9 - Disposal/Burn Area

The Disposal/Burn Area (known as USEPA SWMU 19) is located off Autumn Lane in the central portion of Mainside, adjacent to the southwestern shore of Gambo Creek and north of Site 58.

The history of Site 9 has been documented primarily from an Environmental Photographic Interpretation Center (EPIC) analysis of aerial photographs (USEPA, 1992). A summary of the site history is discussed in the following paragraphs.

Documentation of activity at the Disposal/Burn Area began in 1937. Evidence of waste disposal in the northern and eastern portions of the site and along the edge of the marsh adjacent to Gambo Creek was observed in the 1943 imagery. Continued site expansion and ongoing disposal activity were noted through the 1990 imagery. Evidence of liquid discharges emanating from the perimeter of the fill area flowing south and from the center of the fill area flowing north was observed in the 1953 and 1958 imagery, respectively.

By 1960, filling operations had expanded across the marsh into Gambo Creek, and runoff had stained the surface of the fill area as it flowed toward both the creek and a western channelized drainage path. Two small trenches and a new fill area were observed west of the drainage path. A wide trench, spanning the length of the new fill area and leading to the channelized drainage path, was observed in the 1962 imagery. Evidence of liquid discharge flowing from the original fill area to Gambo Creek was observed in the 1967 imagery, and filling operations had narrowed the width of the main channel. By 1969, filling operations had completely altered the course of Gambo Creek. This change was apparently the result of a large increase in the amount of material disposed of on the east side of the new fill area (USEPA, 1992). A smoke plume was also visible east of the new fill area in the 1969 imagery.

The 1974 imagery showed that the original fill area, which extended north into the wetland, was revegetating while dumping continued in the southern portion of the site. By 1981, fill material had extended over most of the original fill area in the southern portion of the site. Large piles of debris including tree stumps were observed along the fill face and in the center of the site in the 1983 and 1985 imagery. The 1990 imagery indicated that most of the fill areas were revegetating (USEPA, 1992). Drainage continues to flow east from the northern portion of the site into Gambo Creek.

Contaminants of concern at the Disposal/Burn Area include phenols and metals in surface water and/or groundwater. This information was derived from analyses of samples taken during the course of the O'Brien & Gere Confirmation Study completed in 1986. As a part of that study, four groundwater monitoring wells were installed at the site. Samples were subsequently taken in November and December 1983 and once again in November 1984. Leachate samples were also analyzed for hazardous constituents. Based on the results of this study, it was determined that elevated phenol concentrations detected in the groundwater of the Disposal/Burn Area exceeded the VDEQ groundwater quality standards. In addition, TOC and TOX concentrations were above background levels.

RI field activities included a geophysical characterization of the site and evaluation/redevelopment of the existing IR monitoring wells noted above. Field activities also included groundwater sampling of new and existing monitoring wells, surface water and sediment sampling, and seep sampling. These activities were completed in March 1994. The Draft RI report was submitted in September 1995.

After results of the Draft RI were reviewed, it was determined that additional data would be needed to fill data gaps from this investigation. Therefore, a continuation of field activities was conducted between June 1996 and January 1997. Two additional groundwater wells were installed within the water table aquifer at Site 9, along with respective soil borings. Test pits were excavated to identify waste types and to collect samples of buried materials for chemical analysis. Surface water and sediment sampling were primarily performed in the vicinity of Site 58, which is located south of the Site 9 landfill.

Land filling activities at Site 9 have resulted in a variable distribution of compounds. The fill material, which is primarily construction debris, contains PAH compounds, metals, pesticides, and PCB compounds. Many of these constituents have migrated to the marsh area surrounding the site via overland or groundwater transport. Delineation of specific source areas, however, is speculative based on the variable distribution of contaminants which is common at landfill sites.

Based on the RI, there appears to be no threat to human receptors (although ingestion of finfish is a potential concern), however ecological receptors in the marsh areas around the site may be at risk. The most significant ecological risk drivers are heptachlor and several metals (copper, lead, and mercury) present in surface water samples. The FS was completed in August 1998.

A PRAP was prepared for the following remedial alternative: landfill cap and removal of surface debris in the marsh; excavation of Site 58 contaminated soils and placement beneath the landfill cap; upgradient slurry wall to reduce groundwater movement through the waste; marsh cap consisting of a woven geo-textile placed over the waste disposal areas in the marsh; protection of Gambo Creek marsh cap shoreline against Gambo creek erosion; fill in a portion of Gambo Creek and creation of a wetland to create a buffer between the waste and Gambo Creek. The PRAP and a public notice were issued announcing the public comment period starting August 20, 1998 and ending September 18, 1998. No comments were received during the 30-day public comment period or at the Public Meeting held on August 27, 1998. The Navy and USEPA signed a ROD in September 1998, with VDEQ issuing a concurrence letter (U.S. Navy, 1998a).

Construction on the landfill cap and marsh areas started in March 1999 and was completed in November 1999. A Final Closure Report was submitted in November 2000 (OHM Remediation Services Corp., 2000). The Final Closure Report documents the construction process and describes the activities that were performed in executing the closure of the landfill.

Institutional control measures to address site and land-use restrictions have been implemented. A Master Long-Term Monitoring Plan was submitted in June 2003 and was updated in September 2006. Long-term monitoring of the groundwater was performed in April 2002, January 2003, October 2003, July 2004, March 2005, June 2006 and September 2007. For Rounds 1 through 5, few organics were detected and only one, caprolactam, was detected consistently. Caprolactam does not have a MCL or PRG associated with it. A number of metals were detected but did not exceed their respective PRGs set forth in the Site 9 ROD. None of the 11 metals detected in the fifth sampling round exceeded their MCLs. Slightly elevated manganese concentrations above the USEPA BTAG groundwater protection standard of 10 µg/L were detected in four of the five sampling rounds. Perchlorate analysis was also performed on the groundwater samples collected at Site 9 in 2003. No positive results were reported, using a detection limit ranging from 4 to 12 µg/L (TtNUS, 2005c).

In accordance with Appendix 5.4 of the Virginia Solid Waste Regulations, a variance analysis was performed on groundwater sampling Rounds 1 through 5 to identify whether statistically significant contamination above background is evident (TtNUS, 2005c). Vanadium, manganese, TOC, and TOX were identified to be statistically significantly above background concentrations at Site 9 (TtNUS, 2003b). TOC was identified as statistically significantly above background in monitoring well GW 9-12. Filtered vanadium was identified as statistically significantly above background in monitoring well GW 9-13. Total and filtered manganese, filtered vanadium, TOC, and TOX were identified as being statistically significantly above background in monitoring well GW 9-14. Of these constituents, the total and filtered manganese concentrations in GW 9-14 exceeded the GPS of 10 µg/L, but the concentrations of manganese in the well are below the ROD-specified PRGs. There are no ROD-specified PRGs currently available for TOC and TOX. No organic or explosive compounds were determined to be statistically significantly above background.

In January 2006, the DIRT discussed the historical results and agreed that overall, the COCs were decreasing with time and the remedy was working. The only issue was the turbidity of the wells and it was agreed that the solution was to redevelop all the monitoring wells. Based on the continued presence of metals above background concentrations, groundwater monitoring will continue at 15 month intervals throughout the post-closure period.

Round 6 of groundwater sampling occurred in June 2006. Two weeks prior to groundwater sampling activities, the four monitoring wells were redeveloped due to turbidity encountered during previous sampling activities. For Round 6, two VOCs, three SVOCs, TOC, TOX, and 11 metals were detected in the samples. Explosives were not detected in Rounds 1 through 5 and, therefore, were not analyzed in Round 6. No analytes detected in Round 6 exceeded the MCLs or Site 9 RAOs. Manganese and silver were the only two metals in Round 6 to be detected at concentrations exceeding the Site 9 GPSs established for the protection of surface water resources. The manganese and silver GPS exceedances occurred in the samples from groundwater monitoring well GW9-14.

The most recent round of sampling (Round 7) occurred in September 2007. The monitoring wells were redeveloped two weeks prior to the sampling event due to the turbidity in the groundwater. Groundwater purging and sampling activities took place on September 18 and 20, 2007. The results were screened against background concentrations. For Round 7, one VOC, three SVOCs, TOC, TOX, and 14 metals were detected in the samples. No analytes in Round 7 exceed the MCLs or RAOs. Manganese was the only metal in Round 7 to be detected at concentrations exceeding the Site 9 GPSs. The manganese exceeded its GPS in the sample collected from the GW9-14 monitoring well. This downgradient well is located southeast of the landfill.

A review of the Rounds 4 through 7 data indicated that cadmium, silver, manganese, vanadium, cyanide, carbazole, isophorone, and methylene chloride were detected in downgradient well samples but were not detected in any background samples. Of these analytes, vanadium was detected most frequently. The concentrations of these analytes were less than MCLs, ROAs, and GPS levels establishes for the protection of surface water. The next round of groundwater sampling is scheduled for January 2009.

Periodic monitoring of the surface water and sediment was conducted in September 2002, which included four surface water and sediment sampling locations. Surface water samples contained no pesticides or SVOCs, with the exception of one phthalate, a common laboratory contaminant. Inorganic concentrations were generally the same order of magnitude in all samples (TtNUS, 2003b). SVOCs, pesticides, and inorganic constituents were detected in the sediment samples. A comparison of the sediment data against sediment PRGs specified in the Site 9 ROD identified three pesticides in one sediment sample and chromium in another sediment sample above their respective PRGs. However, the concentrations identified were well below the historical maximum concentration at the site.

A second round of surface water and sediment sampling was conducted in November 2004. No organics were detected in the surface water. Twelve inorganics were detected in the surface water samples collected from Site 9. Inorganic concentrations were predominantly the same order of magnitude in all of the surface water samples (TtNUS 2005f). Analysis of sediment samples identified the presence of three pesticides and 18 inorganics in the collected samples. Nickel was identified at 94 mg/kg, which is above its PRG of 34 mg/kg and zinc was identified at 361 mg/kg, which is above its PRG of 234 mg/kg. The concentration of nickel was found to be above the historical maximum concentration, however, the concentration of zinc was found to be within the historical range of concentrations.

The latest round of surface water and sediment sampling was conducted in October 2006. Two SVOCs (bis-2-ethyhyxylphthalate and caprolactam) were detected in the surface water samples but neither one has an associated AWQC. No pesticides or PCBs were detected in the surface water samples. Thirteen metals were detected in the surface water samples from Site 9. Of the thirteen samples, aluminum, iron, and nickel exceeded their AWQC. A direct comparison of the sediment data against the sediment PRGs specified in the Site 9 ROD identified copper, nickel and zinc as present above their respective PRGs. The maximum detected concentration of copper (34.9 mg/kg) and zinc (635 mg/kg) were within their historical concentration range. The maximum detected concentration of nickel (129 mg/kg) was above its historical maximum concentration. In comparison with previous results, this round clearly had more detections of constituents (primarily SVOCs and pesticides) than the previous sampling round. However, the number of those detections exceeding PRGs only increased by one constituent over the previous round. One possible reason for this is the above average rainfall (+2.52 inches) that occurred in the month prior to sampling. This rainfall may have mobilized additional constituents into the areas surrounding the landfill. The next surface water and sediment sampling round is scheduled for January 2009.

Wetland monitoring of Site 9, which includes two semi-annual inspections of each wetland mitigation project area (Sediment Basin Area and the Backchannel Area), began in Fall 2003. At a meeting with EPA BTAG in February 2006, it was decided that starting in Spring 2006, the quantitative evaluation of wetland vegetation, through the use of plot-based data, should be replaced with a qualitative evaluation. Spraying of the phragmites clumps observed in 2005 was also recommended. A qualitative evaluation of the Site 9 wetland was performed in April and October 2006. The report issued was the draft 2006 report, which included the Spring and Fall 2006 monitoring events (JMWA, 2007a). Although a slight increase (10 percent) in the amount of cattail in the Backchannel was observed in 2006, it was decided that since cattail is a native species, eradication is not necessary as long as a diversity of wetlands vegetation persists. The Fall 2006 monitoring event also confirmed the absence of phragmites at the site, with only some dead clumps being observed. Both the Backchannel and Sediment Basin wetland areas appear to be developing toward a diverse stand of indigenous vegetation and no other action was recommended at that time.

The 2007 wetland inspections were conducted on May 9, 2007 and November 8, 2007. The Draft 2007 Annual Wetland Monitoring Report was submitted January 2008. EPA BTAG comments regarding the report were received May 2008. Observations made during the monitoring events suggested that the entire former Sediment Basin was successfully converted into a tidal wetland and mixed stands of wetland vegetation continued to dominate. Observations throughout the five-year monitoring program indicate that the sediment basin has been successfully converted into a tidal marsh. No invasive plant species were observed during the monitoring period. No further action was recommended for the Sediment Basin. Observations during the Backchannel monitoring suggest that the area has been successfully converted into a tidal wetland. Any Phragmites that survived the October 2007 herbicide treatment should be retreated in October 2008 and annually thereafter until Phragmites is eradicated from the Backchannel. The next round of wetland monitoring is scheduled for June 2008.

Based on comments received by the EPA BTAG on the FY 2003 Wetlands Monitoring Report, it was decided that benthic macroinvertebrate sampling should be conducted to ensure that a diverse community of benthic macroinvertebrates that displays ecological functions typical of similar natural wetlands is developing in the sediment of the wetlands at Site 9. The first benthic macroinvertebrate sampling event took place in May 2005 and the findings for the Sediment Basin Area were:

- Abundant number of organisms were present
- Overwhelmingly dominated by the Tubificidae Family

- Low diversity of organisms
- High pollution tolerance

The findings for the Backchannel Area were:

- Abundant number of organisms
- Dominated by Amnicola limosus – a freshwater snail
- Other taxa are mostly tubificid worms and chironomid midges
- Diversity roughly equivalent to reference site
- Pollution tolerance roughly equivalent to reference site

Benthic macroinvertebrate sampling was performed again in July 2007 and approximately twice the number of samples were collected to generate sufficient data to quantitatively evaluate the development of an adequate benthic macroinvertebrate community. The tidal marsh constructed in the Sediment Basin has developed a substantial benthic community. There was no substantial increase in taxonomic diversity from the 2005 to 2007 monitoring event. The data collected in 2005 suggested that the wetlands constructed in the Gambo Creek Backchannel had developed a benthic community whose taxonomic diversity and pollution tolerance approach those of adjoining intact natural tidal marshes. The 2007 data suggest that the Backchannel still supports a benthic community generally similar to that of adjoining tidal marshes. The next round of benthic macroinvertebrate sampling is scheduled for June 2009.

The first Five-Year Review of Site 9 has been completed. A site visit was conducted in December 2003 and a final report was issued in December 2004 (JMWA, 2004d). The final report indicated that the Site 9 remedy is protective of human health and the environment and is functioning as intended. However, several issues which if not addressed, could affect the future performance of the landfill cap. These issues include erosion beneath the Reno mattresses along Gambo Creek, burrowing of animals into a lateral drain, and settling of monitoring well casings. The disturbance of the lateral drain has been restored to its original condition by NSF Dahlgren. The elevations of the monitoring well casings are not expected to impact Long Term Monitoring (LTM) results but will continue to be monitored. The next Five-Year Review is scheduled to be conducted in September 2008 with a final report to be completed in January 2009.

To address the erosion beneath the Reno mattresses, a design to stabilize the embankment and prevent undercutting of the marsh cap next to Gambo Creek was performed. Field Support Services Inc. (FSSI) and Shaw Environment and Infrastructure (Shaw) mobilized on September 11, 2006. After the existing Reno mattresses were removed, an excavator was used to dig a toe/footer to key the protective armor into the face of the repair area. A layer of high strength Amoco 2016 woven geotextile and an overlying layer of Tensar BX-1100 Geogrid were then installed. The geotextile and geogrid were spread approximately 8 to 10 feet horizontally and in a north south direction underlying the entire length of the riprap repair area.

The geotextile and geogrid were covered with D_{50} 12-inch diameter Class 1 riprap that was installed to its natural angle of repose to a height not to exceed two feet above the Marsh Cap. Approximately 265 tons of riprap was placed on the repair area using the long reach excavator. Work was completed and a final inspection was conducted at the site on September 22, 2006.

As a result of the Phase II Gambo Creek Ecological Assessment conducted previously, supplemental sediment samples were collected in the marsh area east of Site 9 in October 2006 to fill in spatial data gaps. Based upon the results of that sampling, arsenic, barium, cobalt and manganese exceeded their respective Effects Concentration (EC) at sample location GC-53, and nickel exceeded its EC at sample locations GC-52 and GC-53. GC-53 is located approximately 400 feet downgradient of the landfill. However, when these sampling results were compared to the results of the historic sampling and the Long-Term Monitoring sampling at Site 9, those chemicals that exceeded the Gambo Creek EC in samples collected east of Site 9 were not found to be highly elevated in comparison with concentrations typically found at the site. No evidence of additional sources or hot spots were identified and the current remedial action appears effective in mitigating the spread of elevated concentrations of contaminants into the marsh east of Site 9 and Gambo Creek

A Landfill O&M Manual that includes Site 9 was prepared in May 2004 (JMWA, 2004c) and has been presented to the Navy for their use. The O&M Manual addresses all landfill inspection items to check during both periodic and storm event inspections. The VDEQ inspection checklist is included in the manual to aid in performing the annual VDEQ inspection. Maintenance requirements including mowing of vegetation and maintenance of site drainage structures, fences, and monitoring wells are discussed. A landfill inspection was performed by VDEQ on December 2, 2004 and the only major issue identified was the erosion beneath the Reno mattresses along Gambo Creek. It was also recommended that all landfills, including the one at Site 9, be monitored annually for methane.

As a result of the VDEQ inspection, methane monitoring was performed in January 2006 and again in November 2006. Methane was not detected at any of the six gas vents during monitoring. A landfill inspection was performed on December 1, 2006, by VDEQ, and no issues were identified.

The latest round of methane monitoring was performed on September 12, 2007. During the monitoring event, methane was detected at two of the six gas vent locations, but did not exceed the 100 percent methane LEL at any of the locations. It should be noted that methane detection at Site 9 had decreased significantly since the previous monitoring event in June 2007, where at five of the six locations methane was detected and exceeded the 100 percent LEL at three of those five locations. A VDEQ landfill inspection was conducted on December 18, 2007 and no significant issues were identified with the exception of groundwater monitoring well casing subsidence. VDEQ recommended abandoning and replacing monitoring well GW9-13 due to apparent subsidence. The well is scheduled to be replaced in June 2008. The next methane monitoring event is scheduled for June 2008.

SITE 10 - Hideaway Pond

Hideaway Pond (known as USEPA AOC N) is a 15-acre, man-made body of water created along a marshy drainage that flows in a southerly direction into Gambo Creek. The pond is located in the northeast corner of Mainside on the NSF Dahlgren, approximately 1,500 feet west of the Potomac River and 2,000 feet south of U.S. Highway 301. Two small tributaries to Hideaway Pond drain a relatively small area north of the pond. Hideaway Pond and its two tributaries are a part of the larger Gambo Creek drainage area in the northeast portion of the NSF Dahlgren. Gambo Creek eventually drains into the Potomac River, about one-half mile north of Upper Machodoc Creek.

Bridge and road building activities in the immediate vicinity of Hideaway Pond began during the late 1930s and early 1940s. In 1953 the bridge and road across the drainage were combined to form a dam that caused the stream to flood to the north. By 1981, flooding had occurred south of the dam, and in 1983 a new dam was constructed approximately 400 feet north of Bagby Road. The area between the new dam and the original dam flooded and the old roadway and dam that formed the original pond were largely removed. Other activities that occurred upstream (near the tributaries draining into Hideaway Pond) included the construction of Building 1400. Another area upstream of Hideaway Pond, just north of Building 1400 and south of U.S. Highway 301, was used for 8 years in the early 1970s as a sanitary landfill operation (Site 17, 1400 Area Landfill) (Fred C. Hart Associates, Inc., 1983). Information regarding disposal of materials into Hideaway Pond or its tributaries was not supplied in the IAS.

Hideaway Pond was open to employees for recreational fishing until 1980. At that time, it was requested that fish tissue samples be tested in an attempt to investigate an anonymous report that mercury had been disposed of in the area between the two tributaries of the pond and that Hideaway Pond itself might be contaminated.

Potential mercury contamination is the primary concern at Hideaway Pond. A Confirmation Study conducted by O'Brien and Gere in 1986 indicated that mercury was not detected in water samples from the two tributary streams and the pond. Plants from the shores of the pond and streams did, however, exhibit mercury accumulation. Mercury concentrations in sediments were above detection limits and showed a pattern suggesting the upgradient landfill was a possible source. The pond was drained in 1990, all fish were removed, and the pond was restocked. Analysis of soil and groundwater samples collected from the 1400 Area Landfill showed that present mercury contributions are negligible. Continued monitoring was recommended as an advance indicator of any potential future contaminant release.

RI field activities included surface water and sediment sampling and were completed in March 1994. The Draft RI report was submitted in September 1995. After the results of the Draft RI were reviewed, it was determined that additional data would be needed to fill data gaps from this investigation. Therefore, a continuation of field activities for an Addendum RI was conducted between June 6, 1996 and January 8, 1997. Addendum RI field activities included a sampling scheme to collect surface water and sediment samples in both the old and new sections of the pond as well as from tributaries and discharge areas. Mercury analysis using a low-level detection limit was used during sample analysis. An Addendum RI, issued in July 2000, confirmed that Site 17, 1400 Area Landfill, was the likely source of the mercury contamination and recommended that an FS be conducted at Hideaway Pond because human health risks associated with fish consumption and ecological risks associated with food chain effects were unacceptable. The FS was issued in July 2000.

A PRAP was prepared for the following alternative: implementation of institutional controls and mercury monitoring of fish (U.S. Navy, 2000b). The PRAP and a public notice were issued announcing the public comment period starting July 20, 2000 and ending August 19, 2000. No comments were received during the 30-day public comment period or at the Public Meeting held on August 9, 2000. The Navy and USEPA signed a ROD in September 2000, with VDEQ issuing a concurrence letter (U.S. Navy, 2000d).

The Remedial Action for Site 10 included institutional controls of posting signs around Hideaway Pond establishing a fish catch-and-release policy, and biannual sampling of fish tissue for the presence of mercury.

Long-term monitoring of fish tissue at Site 10 was initiated in October 2001 (TtNUS, 2001f) with a second round of fish tissue being collected in October 2003 (TtNUS, 2004d). After the two rounds of fish sampling, an increasing trend in mercury concentration in the fish tissue samples in both whole fish and the fillet samples was identified. This trend has a greater impact on the fish and other aquatic life in the pond than on humans, since human consumption of the mercury contaminated fish is prohibited through institutional controls.

A third round of fish sampling took place at Site 10 in October 2006 (TtNUS, 2006). The data from sampling indicates that overall, mercury concentrations in all fish species had dropped or remained the same in both whole fish and fillet samples, when compared with the second round results. As the data indicates, mercury concentrations have remained below the lower threshold value (LTV) consistent with the previous sampling results for both bluegill and catfish/carp, it was determined that no future sampling of those fish species is required. However, for largemouth bass it was determined that at least one more round of sampling and analysis will be required in order to satisfy the ROD requirement for two consecutive rounds of sampling with mercury concentrations less than the RAOs in both fillets and whole fish. The RAOs are to prevent the accumulation of mercury in fish tissue above 0.48 mg/kg and prevent humans from eating fish with mercury concentrations above 0.56 mg/kg. The next round of fish sampling is scheduled for October 2008.

The first Five-Year Review of Site 10 was conducted in December 2003 and a Five-Year Review report was issued in December 2004 (JMWA, 2004d). The final report indicated that the Site 10 remedy is protective of human health and the environment and is functioning as intended. The Five-Year Review did not recommend any additional action. The next Five-Year Review is scheduled to be conducted in September 2008 with reporting to be completed in January 2009.

SITE 12 - Chemical Burn Area

The Chemical Burn Area (known as USEPA SWMU 44) is located in the northern half of Mainside, near the east bank of Gambo Creek and northwest of the Fenced Ordnance Burial Area (Site 2). Analysis of historical aerial photographs indicates that the area was used for demolition-type activities as early as 1943. A chemical burn pit appeared onsite between 1964 and 1967. The IAS reported that the existing fence around this site was erected in 1970. The fenced Chemical Burn Area, including the chemical burn pit and associated facilities, was approximately 50 feet square. The pit was closed in late 1986.

Burning at the site destroyed quantities of decontaminated chemical warfare (CW) solution rendered safe in the laboratory by neutralization. The frequency of burning was estimated to be three to four times per year. Accumulated surface water in the pit was pumped out onto the adjacent ground surface to prepare the site for burning. The IAS did not identify the nature of the residues resulting from the burning operations.

The fire department performed a one-time pallet burning exercise in the area between the road and Chemical Burn Pit. The bare area northeast of the old chemical burn pit was used on several occasions for land farming of oil-contaminated materials during the early 1980s.

A Confirmation Study conducted by O'Brien and Gere in 1986 indicated that detectable levels of TOC were present in groundwater samples from both upgradient and downgradient wells located onsite. The monitoring well closest to the burn pit also contained detectable levels of sodium, chloride, sulfate, and TOX.

RI field activities involved evaluation/rehabilitation of the existing IR monitoring wells located at the site. Field activities also included groundwater sampling of new and existing monitoring wells, surface water and sediment sampling, and soil sampling. These activities were completed in March 1994. The Draft RI report was submitted in September 1995.

After the results of the Draft RI were reviewed, it was determined that additional data would be needed to fill data gaps from this investigation. Therefore, a continuation of field activities was conducted between June 6, 1996 and January 8, 1997. Four additional groundwater wells were installed within the water table aquifer. One additional well was installed in the upper confined aquifer to investigate the potential for vertical migration of dense non-aqueous phase liquid (DNAPL) contaminants. An investigation was conducted to determine if free-product DNAPL was present at the bottom of the water table aquifer. Based on the high concentrations of VOCs in well GW 12-8D, free-product DNAPL was suspected to be present in the subsurface and migration may have been influenced by the orientation of the upper confining layer which was suspected to slope to the east. The free-product investigation was conducted by collecting groundwater samples using a hydropunch. In addition to the groundwater investigation, surface and subsurface soil samples were collected and one test pit was excavated to determine the nature of an electromagnetic anomaly detected in the burn pit.

The primary concern associated with past activities at Site 12 is the impact from VOCs in the soil matrix and the shallow groundwater system. The data suggest that chlorinated solvents (primarily 1,1,1-TCA) were used in the Chemical Burn Pit at a high concentration that excess compounds have migrated through the vadose zone and into the saturated zone. The impact is limited to soil within the pit itself, and no significant migration through overland flow or transport in the vadose zone was demonstrated. A significant concentration of the VOCs, however, has remained on the soil particles in the saturated zone, and these compounds serve as a source for the groundwater contamination. The presence of DNAPLs appears to be limited to the area just below the pit, based on groundwater analytical results from well GW 12-8D. This data shows that vertical migration of DNAPLs through the upper confining layer has not occurred.

The results of the human health risk assessment indicate that no potential human health hazards are associated with exposure to media at Site 12. The results of the ecological risk assessment indicate that the greatest ecological risks currently present at Site 12 are likely due to the presence of mercury in sediment and copper in surface water. The source of mercury in the Gambo Creek sediment is not known; however, Site 12 cannot be demonstrated as the sole source. There is a significant degree of uncertainty associated with potential future ecological impacts, particularly to receptor populations in Gambo Creek. Groundwater to surface water contaminant transport may pose unacceptable ecological risk in the future.

The RI, incorporating the additional site investigation data, was completed July 1997. An FS, completed in July 1997, was prepared to provide remedial action alternatives for Site 12. Technologies and process options were evaluated and screened to develop remedial alternatives. A PRAP was prepared for air sparging/soil vapor extraction (AS/SVE) for groundwater and subsurface soils, and institutional controls (for groundwater and soils). The PRAP and a public notice were issued announcing the public comment period starting July 16, 1997 and ending August 15, 1997. No written comments were received during the 30-day public comment period, or during the Public Meeting held on August 6, 1997. The Navy and USEPA signed a ROD in September 1997, with VDEQ issuing a concurrence letter (U.S. Navy, 1997b).

A pilot-scale AS/SVE system was installed in March 1998. A letter report was submitted documenting the pilot-scale results and recommending modification of the system to a full-scale operation (B&R Environmental, 1998b). Shortly thereafter, six additional air injection wells and five additional vapor extraction wells were installed for the full-scale operation.

The system was in operation 24 hours a day from May 2000 until November 2000. Groundwater and air samples were taken periodically to monitor the performance. The remediation goals for groundwater stated in the ROD were higher than established MCLs. Based on comments received from USEPA, the Navy attempted to reach MCLs in the groundwater at Site 12. In an effort to reach the MCLs, the AS/SVE system was restarted in October 2001. A round of groundwater samples taken at that time indicated that the groundwater concentrations were still below the remediation goals stated in the ROD; however, some rebound in concentrations occurred during the year when the system was shut down. In June 2002, TtNUS issued a draft Remedial Operation Technical Memorandum for Site 12 which included a revised human health risk assessment. The revised human health risk assessment considered residential risk scenarios (not included in the original risk assessment) and the latest risk assessment guidance. New proposed remediation levels consistent with MCLs were included in this document.

The Navy has contracted with phA-Environmental Restoration Corporation (phA-ER) to implement the Magnus™ Technology at Site 12. The Magnus™ Technology is being used to help achieve the remediation levels presented in the Remedial Operation Technical Memorandum. This technology involves injecting a cocktail of nutrients including propane and nitrous oxide through the existing air sparging wells into the groundwater. The nutrients enhance the growth of naturally occurring microorganisms which degrade the contaminants in situ. Additional air sparging wells were installed at Site 12 and the system was brought on line in October 2002. TtNUS has collected periodic groundwater samples at Site 12 beginning with a baseline for the Magnus™ system in January 2003, about three months after the initial startup. The January 2003 data showed a significant reduction in VOC concentrations.

Based on the periodic monitoring data it was decided in December 2003 to modify the Magnus™ system in an attempt to speed up the remediation process. Shortly after the April 2004 sampling results were received, phA-ER modified their system by adjusting the balance of airflow through the system and also by connecting their system to existing air extraction wells in an attempt to enhance bioremediation in the vadose zone. Samples were collected in November 2004 and February 2005. Data showed the concentration of the parent chemical 1,1,1-TCA had decreased in the majority of the wells, the concentrations of the degradation contaminants 1,1-dichloroethane (1,1-DCA) and 1,1 dichloroethene (1,1-DCE) had either stabilized or increased. The Recommended Remediation Level (RRL) for 1,1,1-TCA (200 µg/L) is close to having been achieved; however, the RRLs for 1,1-DCA (106 µg/L) and 1,1-DCE (7 µg/L) are not close to being achieved. This stalling or increase in contaminant concentrations is likely due to the less than favorable geochemistry conditions, including the low pH levels.

TtNUS presented the Draft Site 12 Technical Memorandum at the May 2005 DIRT meeting and at that time it was decided to continue to operate the Magnus™ system and to perform the following:

- Analyze samples for additional Monitored Natural Attenuation (MNA) parameters such as carbon dioxide (CO_2), TOC, alkalinity, dissolved gases, cations and anions, and ammonia, phosphate and nitrates.

- Analyze samples for microorganisms present in order to optimize bioaugmentation.

- Possible source removal since it appears to be a point source.

The first Five-Year Review of Site 12 was conducted in December 2003 and a final Five-Year Review report was submitted in December 2004 (JMWA, 2004d). The report indicated that the Site 12 remedy is protective of human health and the environment and is functioning as intended. Although an overall decreasing trend in VOC contamination in the groundwater has been documented from both the AS/SVE and the Magnus™ systems, not all the RAOs and RRLs have been attained. The next Five-Year Review is scheduled to be conducted in September 2008 with a final report to be completed in January 2009.

After a review of the sampling results over approximately 5 years, the DIRT agreed that additional treatment was not necessary since most of the groundwater RAOs have been met, and operation of the AS/SVE Magnus™ system was discontinued in Fall 2005. However, it was decided that some form of source removal is necessary to eliminate any residual areas of contaminated soil that may act as a continuing groundwater contaminant source.

The February 2005 round of groundwater data showed that the groundwater contaminant levels in the aquifer were not decreasing despite the enhanced bioremediation technology that was employed. It was decided that the collection of additional data from Site 12 was needed so that a more thorough evaluation of the aquifer, including collection of parameters important to biological degradation within the aquifer should be completed. It was decided that soil borings would be installed at the site to determine the limit of the former Chemical Burn Pit, and that this information would then be used to evaluate the feasibility of removing the Burn Pit.

A total of nine wells were sampled in Fall 2006 as part of the monitoring program and were analyzed for chemical, geochemical, and biological parameters. The data was presented at the February 2007 partnering meeting. The results indicate that the VOC concentrations have increased in both injection and monitoring wells since the last round of groundwater data collection in 2005. The maximum concentration of 1,1,1-TCA had increased from 220 to 4,700 ug/L, the maximum concentration of 1,1-DCA had increased from 1,100 to 2,100 ug/L, and 1,1-DCE had increased from 64 to 280 µg/L. However, the high concentrations were limited to a small area in the center of the site. The inorganic concentrations were similar to previous rounds of sample results. The geochemical and microbial data indicated that the very little microbial activity was currently occurring at the site and the likely cause was the low pH in the groundwater.

Alternatives for further remediation of the groundwater at Site 12 were evaluated and presented at the February 2007 partnering meeting. Based on these discussions, excavation of the Burn Pit and long term monitoring of the groundwater is the recommended alternative. The results of the Site 12 field work and remedy evaluation were presented in the “Technical Memorandum for Sampling Results and Remedy Evaluation for Site 12” (TtNUS, 2007c).

Since the above alternative differs from the selected remedy in the ROD, an Explanation of Significant Differences (ESD) was required to justify and document the differences between the two remedies. The final ESD was completed in September 2007. The ESD was advertised to the public on September 12, 2007. Historical activities in the area included chemical warfare agents being used and neutralized at nearby Site 14. The neutralized CW agents were then disposed of at Site 12. Therefore, prior to excavation of the former burn pit at Site 12, it was decided by the DIRT to sample for CW agents at Site 12 in conjunction with work at Site 14. Sampling at Site 12 was completed in November 2007. Six soil samples were collected for CW agent analysis. Results were negative for the analytes. The soil is currently being analyzed for waste characterization within the pit area.

A draft SSP UFP-SAP for verification sampling of the pit excavation is currently under review by the DIRT and Navy chemist staff. An Explosive Safety Submission (ESS) Determination was issued from NOSSA in March 08. Based on the information provided, NOSSA determined that an ESS was not required for vegetation removal and soil excavation. However, since the site is within a K18 intraline distance from Magazine 980, a Site Approval Request (SAR) will be required. The SAR is currently being prepared. The current projection for completing the removal action is late Summer 2008.

Table 2-2 presents a listing of operational milestones of the remedial activities to date.

SITE 17 - 1400 Area Landfill

The 1400 Area Landfill (known as USEPA SWMU 30) is located in the northeast corner of the NSF Dahlgren property, north of Frontage Road and south of U.S. Highway 301. The site included areas of disturbed soils, two gravel pits, a landfill, and a pond.

Surface drainage at this site flows to one of the two streams that cross the site from north to south. These streams flow into Hideaway Pond approximately 600 feet south of Building 1400. The small wetland currently located at the site apparently was created by excavation of gravel and was not restored with fill material. The wetland is believed to be less than five feet deep. Analysis of historical aerial photographs indicates that initial surface disturbance in the area began as early as 1943. The area continued to be used into the 1960s for open storage of crates and barrels as well as for gravel mining. These activities ceased by the mid-1960s, and Building 1400 was noted at the site by 1977. The pond was first identified onsite in 1978 and remains to this date.

The IAS reports that in the early 1970s, the area was used for three or four years as a sanitary landfill. Wastes, primarily municipal garbage, were deposited, compacted, and covered on a periodic basis. Other wastes may have been disposed of at this location. A Confirmation Study conducted by O'Brien and Gere in 1986 suggested that mercury contamination suspected in Hideaway Pond (Site 10) may have originated from this site.

TABLE 2-2

**SITE 12 GROUNDWATER TREATMENT MILESTONES
NSF DAHLGREN
PAGE 1 OF 3**

Date	Activity
March 30, 1998	Installation of pilot system began: System includes one air injection well (IW01) and two air extraction wells (EW01 and EW02).
April 15, 1998	Initial start-up of pilot system.
May 15, 1998	Pilot scale tests complete. System continues to run.
July, 1998	Final Phase I Treatability Study Report submitted. * Recommendations made to expand system to full scale. * Air emissions results are reported and are below the limit of 15 pounds VOCs/day.
Sept. 15-24, 1998	System Expanded to Full Scale. * 6 Air injection wells installed (IW02-IW-07) * 5 Air extraction wells installed (EW03-EW07) * Air sample collected, emissions are acceptable * Groundwater samples collected, contaminant levels still above PRGs.
October 20, 1998	TtNUS performs inspection and adjustment of the system. Air sample collected, emissions are acceptable.
October 26-30, 1998	Shed constructed around blowers and motors.
November 18, 1998	TtNUS performs inspection and adjustment of the system. Air sample collected, emissions are acceptable.
December 7, 1998	Three soil samples collected from Burn Pit to determine if soil in this area is still hazardous. One sample has a hit of 380,000 µg/kg of 2-butanone.
December 15, 1998	TtNUS performs inspection and adjustment of the system. Air sample collected, emissions are acceptable.
January 26, 1999	TtNUS performs inspection and adjustment of the system. Air sample collected, emissions are acceptable.
February 24, 1999	TtNUS performs inspection and adjustment of the system. Air sample collected, emissions are acceptable.
March 31- April 6, 1999	Six month evaluation of the system. * Soil samples collected in Burn Pit, no significant detections. * Groundwater samples collected, contaminant levels still above PRGs. * Air sample collected, emissions are acceptable. * An additional extraction well, EW08, is added in the burn pit. * Permanent electrical power is connected to blower motors.
May 27, 1999	TtNUS performs inspection and adjustment of the system. Air sample collected, emissions are acceptable.
July 21, 1999	TtNUS performs inspection and adjustment of the system. Air sample collected, emissions are acceptable.
September 29, 1999	TtNUS performs inspection and adjustment of the system following Hurricane Floyd. No damage from the hurricane.
October 22-29, 1999	12 month evaluation of the system. * Soil samples collected in Burn Pit, no significant detections. * Groundwater samples collected, contaminant levels still above PRGs. * Air sample collected, emissions are acceptable. * Injection well IW07 is replaced since it was no longer accepting air flow. IW08 installed.
January 3, 2000	TtNUS performs inspection and adjustment of the system.
February 2, 2000	TtNUS collects air sample, emissions are acceptable.

TABLE 2-2

SITE 12 GROUNDWATER TREATMENT MILESTONES
NSF DAHLGREN
PAGE 2 OF 3

Date	Activity
May 15-18, 2000	18 month evaluation of the system. * Soil samples collected in Burn Pit, no significant detections * Groundwater samples collected, contaminant levels below PRGs. * Air sample collected, emissions are acceptable * The closest downgradient well is sampled. Concentrations are below PRGs, however the concentrations are higher than previous sampling.
November 6, 2000	System is shut down since groundwater results are below PRGs. Begin process to verify that remediation goals have been permanently achieved. Groundwater sampling to proceed quarterly until two consecutive rounds of groundwater sample results are below remediation goals with the system turned off.
November 9-10, 2000	24 month evaluation of the system. * Groundwater samples collected, contaminant levels still below PRGs. * Groundwater also sampled for metals, results are elevated; but below the PRGs presented in the Site 12 ROD (B&R Environmental, 1997). * Results are indicative of conditions with the AS/SVE system running (since system was only shut off a few days prior).
February 6-8, 2001	27 month evaluation of the system. * Groundwater samples collected (VOCs only), contaminant levels still below PRGs. * Results are indicative of conditions with the AS/SVE system shut down.
October 15-19, 2001	Evaluation of the system after being shut down for approximately 1 year. * Groundwater samples collected (VOCs, DO, and metals only), contaminant levels still below PRGs. * System turned back on.
August 5-6, 2002	Baseline round of groundwater samples prior to startup of Magnus system * Groundwater samples collected (VOCs, DO, and metals only), * AS/SVE System turned off
October 11-23, 2002	phA-ER's Magnus™ system comes on-line.
January, 24-25, 2003	Quarterly groundwater sampling *Groundwater sampled for (VOCs, DO, chloride, and Metals only)
April 21-22, 2003	Quarterly groundwater sampling *Groundwater sampled for (VOCs, DO, chloride, perchlorate, and metals)
October 2003	Quarterly groundwater sampling *Groundwater sampled for (VOCs, DO, chloride, and metals)
April 2004	Groundwater Sampling *Groundwater sampled for (VOCs, DO, chloride, perchlorate, and metals)
May 2004	Changes are made to optimize Magnus™ System
December 2004	CERCLA Five-Year Review Completed.
November 16-18, 2004	Groundwater Sampling *Groundwater sampled for (VOCs, DO, chloride, and metals)
February 9-11, 2005	Groundwater Sampling *Groundwater sampled for (VOCs, DO, chloride, and metals)
May 2005	Draft Tech Memo issued recommending analysis of samples for additional Monitored Natural Attenuation parameters and specific microorganisms.
December 2005	RAOs have mostly been met and phA's Magnus system is discontinued.

TABLE 2-2

**SITE 12 GROUNDWATER TREATMENT MILESTONES
NSF DAHLGREN
PAGE 3 OF 3**

Date	Activity
Spring 2006	DIRT decides to do source removal and do a ROD Amendment to reflect the changes in the remedial technology and remedial action objectives
November 2006	Groundwater was sampled for chemical, geochemical, and biological parameters including VOCs, inorganics, and attenuation parameters. Soil samples were analyzed for VOCs and metals.
February 2007	DIRT discusses alternatives for further remediation of Burn Pit and groundwater at Site 12 and chooses removal for the Burn Pit and long-term monitoring for groundwater. It was decided that an ESD is necessary.
June 2007	Tech Memo issued that discusses 2006 Sampling Results and Remedy Evaluation for Site 12 Chemical Burn Area
September 12, 2007	ESD is signed. ESD availability is advertised in the local newspapers.

RI field activities included a geophysical characterization of the site and evaluation/rehabilitation of the existing IR monitoring wells. Field activities also included groundwater sampling of new and existing monitoring wells, surface water and sediment sampling, and soil sampling. These activities were completed in March 1994. The Draft RI report was submitted in September 1995.

After the results of the Draft RI were reviewed, it was determined that additional data would be needed to fill data gaps from this investigation and additional field activities were conducted between June 1996 and January 1997. One additional groundwater well was installed along with respective soil borings. Surface water, sediment, and surface soil samples were also collected. Test pits were excavated to assist in identifying buried wastes.

Mercury has been the primary driver for investigation of Site 17. However, the chemical data from 1996 indicate that concentrations of mercury are not significant and no source area has been identified. In addition, the human health risk assessment did not identify mercury as a COC, and the ecological assessment identified it as a COC only in surface water. Elevated concentrations of other inorganic constituents were detected in groundwater and surface water collected from the eastern portion of the landfill. Low concentrations of PAHs also were detected in the surface soils and sediments in the northwestern portion of the landfill. The levels observed were well below RBCs.

Results of the human health risk assessment indicate that no significant potential health hazards are associated with exposure to soils at Site 17, and no direct contact with groundwater, surface water, or sediment is anticipated at Site 17. The results of the ecological risk assessment concluded that the risks to terrestrial receptors appear to be limited to the areas around sample locations SS17-4 and SS17-1. The PAHs and Aroclor-1260 at SS17-4 could be harmful to wildlife receptors. In the area of SS17-1, earthworms were determined to be the most sensitive receptor for chromium, and plants may be sensitive to thallium.

A FS was completed in August 1998 to provide remedial action alternatives for Site 17. A PRAP was prepared for the following alternative: vegetative soil cap, offsite disposal of sediments, and phytoremediation to control groundwater levels beneath the landfill. The PRAP and a public notice were issued announcing the public comment period starting August 18, 1998 and ending September 16, 1998. No comments were received during the 30-day public comment period or at the Public Meeting held on August 27, 1998. The Navy and USEPA signed a ROD in September 1998, with VDEQ issuing a concurrence letter (U.S. Navy, 1998b).

The Final Closure Design was submitted in April 2000. Preconstruction submittals and mobilization of personnel and equipment began in April 2000, with full construction underway in May 2000. The construction was completed in December 2000.

Institutional control measures are underway to address site and land-use restrictions. A Long-Term Monitoring Plan was submitted in July 2002 and was revised in 2005. Groundwater samples were collected from six Point of Compliance (POC) monitoring wells and one background well in April 2002, February 2003, October 2003, July 2004, March 2005, June 2006 and September 2007. In Rounds 1 through 4 groundwater samples that were collected, no VOCs have been detected above their associated MCLs (TtNUS, 2005d). A number of metals were detected during the four events and eight of them exceeded the background concentrations. One metal, arsenic, exceeded its MCL of 10 µg/L (within one order of magnitude) in three sampling events. Cadmium was detected at 5.5 µg/L and exceeded its MCL of 5 µg/L during the fourth sampling round. Mercury is the primary COC at Site 17 and although it has been detected in all four sampling rounds, it has never exceeded its MCL of 2 µg/L or its RAO of 0.14 µg/L.

In accordance with Appendix 5.4 of the Virginia Solid Waste Regulations, an analysis of variance was performed on groundwater sampling Rounds 1 through 5 to identify whether statistically significant contamination above background is evident. Three metals (cobalt, mercury, and vanadium) were determined to be statistically significantly above background at Site 17 (TtNUS, 2005d). Although the concentrations of cobalt and vanadium were considered to be statistically significantly above background, there are no Federal MCLs for cobalt or vanadium at this time. None of the mercury concentrations were above the Federal MCL (2 µg/L) nor did they exceed the RAO of 0.14 µg/L set forth in the Site 17 ROD (U.S. Navy, 1998b). No organic compounds, TOC, or TOX were determined to be statistically significantly above background.

Round 5 of groundwater monitoring at Site 17 took place in March and April, 2005. Five VOCs, 12 metals, TOC, and TOX exceeded background concentrations at one or more downgradient well locations. The concentrations of VOCs were less than the MCLs. None of the Round 5 samples exceeded the RAO or the MCL for mercury. Only arsenic and cadmium at one location (GW17-19) exceeded the MCLs. However, the elevated arsenic and cadmium levels in this well are associated with elevated sample turbidity and may be partially due to excessive suspended sediment in the sample.

In January 2006, the DIRT discussed the historical results and agreed that overall, the COCs were decreasing with time and the remedy was working. As was true in the previous rounds, mercury was detected but did not exceed the MCL of 2 µg/L or the RAO of 0.14 µg/L. The only issue was the turbidity of the wells and it was agreed that the solution was to redevelop the monitoring wells. Based on the continued presence of metals above background concentrations, groundwater monitoring will continue at 15 month intervals throughout the post-closure period.

Groundwater at Site 17 was monitored in June 2006 during Round 6 and included redevelopment of the Site 17 monitoring wells. Six VOCs, 16 metals, TOC, and TOX exceeded background concentrations at one or more downgradient well locations. The concentrations of VOCs were less than the MCLs. None of the Round 6 samples exceeded the RAO of 0.14 µg/L or the MCL of 2 µg/L established for mercury in the ROD. Only arsenic and cadmium at one location (GW17-19) exceeded the MCLs. During the Round 5 sampling it was thought that the elevated arsenic and cadmium levels in this well were associated with elevated sample turbidity, >999 nephelometric turbidity units (NTUs). However, in Round 6, which was collected after redevelopment, the turbidity was 31 NTUs and the concentrations of cadmium and arsenic were only slightly lower.

Round 7, the most recent round, was performed in September 2007. Groundwater samples were collected from six downgradient wells and one background well. Six VOCs, eleven metals, TOC and TOX exceeded background concentrations at one or more of the downgradient wells. Round 7 concentrations were less than the MCLs with the exception of arsenic exceeding its MCL. None of the samples exceeded the ROA of 0.14 µg/L for mercury. The next groundwater sampling is scheduled for January 2009.

Initial monitoring of the surface water and sediment was conducted in the April 2002. The monitoring program included the collection of five collocated surface water and sediment samples from tributaries east and west of the landfill and the pond to the west for low-level mercury analysis. Low concentrations of mercury were detected in all five surface water samples obtained during this sampling event. The detected mercury concentrations were well below the maximum mercury concentration detected during the RI (B&R Environmental, 1998). Low-level mercury contamination was also detected in all five sediment samples, but was determined to be a result of blank contamination and not site-related.

A second round of surface water and sediment sampling was conducted in November 2004. Low-level mercury concentrations were detected in three surface water and five sediment sample locations during the second sampling event (TtNUS, 2005e). The mercury concentrations were within the Site 17 historical range of mercury concentrations for surface water and sediment and below the 1998 maximum reported mercury concentration. All concentrations were below the mercury PRG of 100 ng/L for surface water established in the FS.

The third round of surface water and sediment sampling was conducted in October 2006 at the same locations as the previous sampling events. Low concentrations of mercury were detected in all five surface water and collocated sediment samples obtained during sampling. The mercury concentrations were within the Site 17 historical range of mercury concentrations for surface water and sediment, and below the 1998 maximum reported mercury concentration. The detected mercury concentrations were below the PRG for surface water (100 ng/L) established in the Site 17 FS, and below the USEPA BTAG Freshwater sediment value for mercury (0.18 mg/kg). The next surface water and sediment sampling round is scheduled for January 2009.

Wetland monitoring of Site 17, which includes two semi-annual inspections per year of each wetland mitigation project area (east wetland area and west wetland area), began in Fall 2003. During the Spring and Fall 2006 monitoring events observations were made that the East Wetlands continue to be drier than expected, especially the southeast quadrant, but still meet the federal definition for a wetland in at least 75 percent of the area. The hydrology of the West Wetlands is greatly influenced by the presence or absence of the beaver dam in the central pond. The wetlands west of the central pond meet the wetland definition, while those to the east of the pond may not. Some upland, as well as invasive plant species (Lespedeza) were identified in both the East and West Wetlands. If further monitoring indicates that Lespedeza is spreading, some form of control may be necessary. The reconstructed beaver dam should be removed in order to establish regular hydrology in the West Wetlands, as well as to lower the water table beneath the land filled wastes.

The 2007 wetland inspections were conducted on May 9, 2007 and November 6, 2007. The Draft 2007 Annual Wetland Monitoring Report was submitted January 2008. EPA BTAG comments regarding the report were received May 2008. Observations made during the monitoring events suggested that the East Wetlands continue to be drier and developing into mesic uplands forest. Lespedeza has not substantially increased over the five-year monitoring period. It was decided during the March 2008 DIRT meeting to reduce the elevation of the affected area. Contracting is currently being negotiated to reduce the elevation of this area and replant it with wetland species. The soil removal is expected to occur in late summer 2008. The West Wetland was roughly 25 to 50 percent inundated or saturated. Recommendations were made to readjust the acreage figures to reflect the fact that only 75 percent of the eastern wetlands have been successful. This will not be necessary if the elevation reduction is completed as scheduled. The next round of wetland monitoring is scheduled for June 2008.

The first Five-Year Review of Site 17 was conducted in December 2003 and a final report was subsequently prepared (JMWA, 2004d). The final report indicated that the Site 17 remedy is protective of human health and the environment and is functioning as intended. However, several issues which if not addressed, could affect the future performance of the landfill cap. These issues include poor condition of the phytoremediation trees on the surface of the landfill cap and blockage of the pond outfall structure. The blockage at the outfall structure, which was caused by beaver activity, was removed by the Navy.

The causes of poor tree survival were (1) dry conditions, particularly right after planting, (2) poor topsoil fertility, and (3) use of mechanical augering during planting, which smeared the sides of the root holes. The DIRT agreed that supplemental planting was necessary to enhance evapotranspiration of infiltrated rainfall and to maintain compliance with the ROD. The next Five-Year Review is scheduled to be conducted in September 2008 with a final report to be completed in January 2009.

Based on the poor condition of the phytoremediation trees on the landfill cap, a supplemental tree planting design was prepared by TtNUS in Spring 2005. Approximately 600 Hybrid Poplar and 600 American Sycamore seedlings were planted in November 2005. Two-year seedlings were selected to (1) minimize transplant shock, (2) protect against desiccation, and (3) because they are capable of adapting to less than ideal soils. Specific recommendations during planting included: (1) hand planting to prevent smearing of side walls, (2) set up rain reels before planting, (3) direct planting toward gaps in existing tree cover, (4) water during planting, and (5) placement of tree guard tubes. A visual inspection during the Spring and Fall 2006 wetland monitoring events indicated that most of the planted trees are surviving and developing leaves. Hybrid Poplar was particularly prevalent in the western portion of Site 17 where overall stem counts have increased by more than 50 percent since 2005. Similarly, overall stem counts have increased by approximately 20 percent in the eastern portion of Site 17 since 2005.

A count of woody vegetation was also conducted in May 2008. This count was conducted to determine the types and numbers of trees currently on the landfill. The conclusion of the tree counts were that there was poor survival rates of the planted trees on Site 17, however, large numbers of loblolly pines have volunteered on Site 17. The equivalence of the loblolly pines to the designed tree plantings (with respect to phytoremediation) is being evaluated. A preliminary analysis indicated that the loblolly pine can be adequately demonstrated to achieve equivalency. During the May 2008 DIRT meeting is was noted that the loblolly pines would likely take over the site and may have a longer life than the hybrid poplars.

Based on preliminary monitoring requested by VDEQ, methane was discovered in monitoring well GW 17-15 in Spring 2005. Due to the proximity of Building 1400 to this location, there was a concern for people working in the basement of the building. TtNUS conducted soil gas measurements between this well location and the parking lot of Building 1400. Although methane was detected above the LEL in locations closer to the landfill, a row of soil gas measurements adjacent to the parking lot revealed that methane was within acceptable levels. A methane monitor was installed in the basement in April 2005. Neither TtNUS nor the Base fire department has detected methane in the sump of the basement. The DIRT agreed that monitoring in Building 1400 should continue as an interim remedy.

Based on a landfill gas migration assessment conducted in September/October 2005 at Site 17 and the Building 1400 area, the DIRT decided that an interim remedy in the form of a gas interceptor trench with gas monitoring probes (GMPs) should be installed along the fence line between the landfill and Building 1400. Soil gas surveys conducted during April, September, and October 2005 indicate that methane gas was detected at elevated levels along the southern access road of the landfill, with a few elevated detections adjacent to the chain link fence north of Building 1400. The gas interceptor trench was constructed in December 2005 parallel to the southern landfill access road on the south side of the roadway measuring approximately 250 linear feet. The trench is 3 feet wide and approximately 8 feet below ground surface (bgs), which is just above the mean water table elevation. A GMP consisting of a riser pipe and a gas valve was installed every 50 feet along the length of the trench for a total of 15 GMPs.

Weekly methane monitoring began in January 2006 followed by monthly methane monitoring from February to May 2006. As methane concentrations were not varying significantly, only three additional measurements were taken, two in July 2006 and one in October 2006. The objective of methane monitoring was to identify the location of methane hot spots, which will identify the extent of the final methane mitigation plan. The results of these monitoring events are shown in Table 2-3, which indicates the methane LEL is being consistently exceeded at four locations (GMP 17-4, 17-10, 17-11 and PZ 17-1) and at T-vent # 6, during the October 2006 monitoring event. It is worth noting that the LEL at location 17-10 was not exceeded during the October 2006 monitoring event.

The 2006 methane results show a continuing concern for methane migration toward Building 1400. It appears that methane had migrated under the interim gas collection trench between the landfill and Building 1400 during a period when the groundwater elevations dropped below the trench bottom. In addition, it appears that a localized source of methane may be located near Building 1400.

The results of the September 2007 monitoring indicated that methane was detected at eight locations above the 100 percent methane LEL. Sampling locations PZ17-1 and GMP17-20 exhibited the highest LEL percent methane, with concentrations of 1,320 and 1,050 respectively. Hydrogen sulfide was detected in one location, at 1 ppm. The results of the December 2007 monitoring indicated that methane was detected in only six of the locations above 100 percent LEL. It was also noted that nearly all of the sampling locations exhibited a decrease in percent LEL since September 2007, with the exception being GMP17-11, where an increase from 58 to 210 percent LEL was noted. Hydrogen sulfide was again detected in PZ17-1, at less than 1 ppm. Gas monitoring events are to continue on a quarterly basis.

The methane monitoring results discussed above also showed elevated, but less than the LEL, methane readings between Building 1400 and the interim gas collection trench. A localized source of methane was suspected near Building 1400 and was excavated in July 2007. Organic material was not discovered in the excavation. The excavation was filled with clean back fill.

TABLE 2-3

SUMMARY - METHANE MONITORING RESULTS
JULY 2006 to MARCH 2008
NSF DAHLGREN

Site 17 - 1400 Area Landfill - NSFD - Dahlgren, VA

% LEL METHANE

Sampling Location	Sampling Date					
	21-Jul-06	19-Oct-06	28-Jun-07	12-Sep-07	14-Dec-07	11-Mar-08
GW17-12	**4**	**40**	0	0	0	**166**
GW17-15	0	0	0	0	0	**2**
GW17-18	0	0	**2**	0	0	0
GW17-19	0	0	**2**	**68**	**2**	0
GW17-20	0	0	**4**	**4**	0	0
GW17-21	0	0	**2**	0	0	0
PZ17-1	**1,420**	**1,504**	**1,660**	**1,320**	**834**	**800**
PZ17-2	0	0	**2**	**4**	**2**	0
PZ17-3	0	0	**2**	**4**	**2**	0
PZ17-4	0	0	0	**660**	0	0
PZ17-5	**6**	**80**	**338**	**440**	**18**	0
PZ17-6	0	0	**2**	**2**	**2**	0
PZ17-7	0	0	0	0	0	0
GMP17-2	0	0	0	0	**8**	0
GMP17-3	0	0	0	0	**8**	0
GMP17-4	**652**	**304**	**52**	**152**	0	0
GMP17-5	0	0	0	0	0	0
GMP17-6	0	0	0	0	0	0
GMP17-7	0	**6**	0	**240**	**260**	0
GMP17-8	0	0	0	0	0	0
GMP17-9	0	0	0	0	0	0
GMP17-10	**276**	**6**	**2**	0	0	0
GMP17-11	**160**	**122**	0	**58**	**210**	0
GMP17-12	0	0	0	0	0	0
GMP17-13	0	0	0	0	0	0
GMP17-14	0	0	**2**	0	0	0
GMP17-15	**22**	**2**	**2**	**152**	**120**	0
GMP17-16	0	0	0	0	0	0
GMP17-17	NA	NA	NA	0	0	0
GMP17-18	NA	NA	NA	0	0	0
GMP17-19	NA	NA	NA	**880**	**740**	**460**
GMP17-20	NA	NA	NA	**1,050**	**862**	**820**
GMP17-21	NA	NA	NA	**10**	**26**	0
GMP17-22	NA	NA	NA	**4**	0	0
Tvent #1	0	0	0	0	0	0
Tvent #2	0	0	0	0	0	0
Tvent #3	0	0	0	0	0	0
Tvent #4	0	0	0	0	0	0
Tvent #5	0	0	0	0	0	0
Tvent #6	0	**150**	0	0	0	0
Inlet 1	0	NA	NA	NA	0	NA
Inlet 2	0	NA	NA	NA	0	NA
Inlet 3	0	NA	NA	NA	0	NA
Outlet Pipe	0	NA	NA	NA	0	NA
Gate & 1400	0	0	0	0	0	NA
W. End Rd.	0	0	0	0	0	NA
Pond Outfall	0	0	0	0	0	NA

Bold value indicates methane was detected.
All values are Active - Pump On readings.
NA - Not analyzed.

During discussions with the partnering team, it was decided that a deeper gas collection trench will be constructed around the southern perimeter of the landfill and will be extended eastward toward the Eastern tributary. This deeper trench will be constructed at an elevation such that the seasonal low groundwater will not drop below the bottom of the trench. These decisions were documented in the Final Landfill Gas Migration Mitigation Plan which was submitted in December 2007 (TtNUS, 2007e). In January 2008 the draft Construction Work Plan for the Proposed Trench was submitted for review. In April 2008 several test trenches were excavated along the alignment of the proposed gas collection trench to determine the feasibility of constructing the trench as an open cut. Due to a fine sand and gravel layer found at 4 to 11 feet below grade, the test trenches collapsed shortly after the excavation. It was determined that soils at 4 to 11 feet subgrade will not support open trench excavations and become unstable within a hour of excavation. The configuration of the trench is currently being reviewed to determine a more practical construction technique and/or design for the gas collection trench. During the May 2008 DIRT meeting it was discussed that an alternative, including the installation of a slurry wall using a one-pass trenching technology, may be implemented. A second trench to include gravel and piping could be installed to vent gas on the landfill side of the slurry wall. No final decision was made during the May 2008 DIRT meeting.

Based on the possibility of future construction activities north of Site 17, six additional GMPs were installed just north of the northern drainage ditch in July 2007. The objective of installing these GMPs was to detect any methane that may be migrating outward (north in this case) from the landfill. The design was similar to the existing GMPs south of the landfill, except they are sufficient in depth to extend to the groundwater table even during drier periods. The gas monitoring probes north of the landfill were sampled shortly after installation on July 13, 2007 and showed low detections of methane, however, these probes were sampled again in September and December 2007. During both of these later sampling rounds, methane concentrations exceeded 800 percent of the LEL with the highest reading coming in GMP17-20 with a concentration of 1050 percent LEL. The gas monitoring results in 2007 (from June, July, September and December) showed continuing concentrations of methane south of the landfill.

A Landfill O&M Manual that includes Site 17 was prepared in May 2004 (JMWA, 2004c) and has been presented to the Navy for their use. The O&M Manual addresses all landfill inspection items to check during both periodic and storm event inspections. The VDEQ inspection checklist is included in the manual to aid in performing the annual VDEQ inspection. The maintenance requirements presented in the manual include maintenance of site drainage structures, surface vegetation, fences, and monitoring wells.

A Landfill inspection was performed by VDEQ on December 2, 2004 and two issues were identified: the potential for methane migration to Building 1400, which has been addressed by methane monitoring and a temporary interceptor trench between the landfill and Building 1400. The second issue was continued inspections of the pond to ensure the beavers did not reconstruct a dam at the pond's outfall structure. A second landfill inspection was performed by VDEQ on March 20, 2006 and although no beaver was present, VDEQ recommended an increase in the frequency of inspections to ensure the beavers do not construct a new dam. In preparation of constructing the gas management trench in 2008, obstructions at the outlet of the pond were removed and the pond elevation was lowered by removing batter boards from the pond discharge structure.

The most recent landfill inspection was conducted on December 18, 2007. Recommendations were made to repair the damage done during monitoring events, a few areas were cleared and tire ruts were noted. One of the ballards surrounding monitoring well GW17-12 was damaged and an irrigation pipe was noted on the well pad. Other than these minor concerns, no major issues were identified.

SITE 19 - Transformer Draining Area

The Transformer Draining Area (known as USEPA AOC G) is located in the south-central portion of Mainside, approximately 150 feet east of Caskey Road. Analysis of historical aerial photographs indicate that open storage of materials around what is presently Building 120B began as early as 1943 and continued into the 1980s.

The IAS reports that during the 1950s, the normal procedure at NSF Dahlgren was to drain transformer oil onto the ground behind the present Property Disposal Office. The transformers were then turned in to the property disposal site. Surface drainage from the disposal area is south-southwest for approximately 100 yards and southeast toward Building 414. The amount of oil involved was roughly estimated to be 1,000 gallons. No data regarding the PCB content of the oil is available.

A Confirmation Study conducted by O'Brien and Gere in 1986 revealed the presence of PCBs in a number of soil samples taken from sampling points north of the concrete pad in the area where the oil was drained from the transformers. Three of these samples contained concentrations of PCBs above the 50 milligrams per kilogram (mg/kg) level established by the Toxic Substances Control Act of 1978 (TSCA). Groundwater samples were found to be free of PCBs.

RI field activities involved evaluation/rehabilitation of the existing IR monitoring wells located at the site. Field activities also included groundwater sampling of existing and new (installed during the RI) monitoring wells, soil sampling, and sampling of concrete chips. These activities were completed in March 1994. The Draft RI report was submitted in September 1994.

A removal action was conducted at this site to remove soil contaminated with PCBs. The excavation began in December 1994 and site activities were completed by February 1995. Approximately 282 tons of soil were removed to a level of one part per million (ppm) PCBs and disposed of at an approved permitted TSCA landfill.

The RI/FS Addendum was finalized in July 1999. The RI/FS conducted for Site 19 indicated PCBs in soil were the only contaminants that warranted remedial action within the soil media. Subsequently, the PCB-contaminated soil was excavated and disposed of off-site. Sampling data collected during the removal action were evaluated in a revised risk assessment which indicated that the remaining risks were acceptable. Groundwater in the shallow aquifer beneath Site 19 is not a current source of drinking water. Groundwater contaminants were evaluated in conjunction with an adjacent site (Site 40, which is addressed in section 2.4). A PRAP and public notice were issued announcing the public comment period starting on July 21, 1999 and ending on August 19, 1999. The Navy and USEPA signed a ROD in September 1999 indicating no further action was necessary at Site 19, with VDEQ issuing a concurrence letter (U.S. Navy, 1999g).

SITE 25 - Pesticide Rinse Area

The Pesticide Rinse Area (known as USEPA SWMU 66) is located in the southern portion of the NSF Dahlgren, approximately 700 feet northwest of Upper Machodoc Creek. The ground surface at the Pesticide Rinse Area (SWMU 66) has been characterized as having a variety of surface conditions that include pavement, gravel cover, and grass. A swale in the southern portion of the site is covered in tall grass, reeds, and related marsh-type plants. Maximum elevations of 15 feet or less occur near railroad tracks. Slopes are gentle in the area, typically less than five percent. Surface drainage at the Pesticide Rinse Area is toward the swale, which flows eastward into Upper Machodoc Creek.

Analysis of historical aerial photographs indicates that an inlet was filled in during the late 1930s to mid-1940s. Buildings, roads, and yard areas began to develop during this time. Evidence of possible ground staining, liquid, and erosion features, particularly in the southwest corner of the unpaved parking area, was noted in the 1960s and late 1970s.

The IAS reports that past waste handling practices at the Pesticide Rinse Area (SWMU 66) included the rinsing of empty pesticide containers with wash waters. These wastes moved overland from the gravel/paved area near Building 946 to a surface drainage swale. A slop sink in Building 134 was piped to a French drain west of Building 134.

A Confirmation Study conducted by O'Brien and Gere in 1986 revealed that shallow surface soils at two locations near Building 134 contained pesticides. Pesticides have penetrated to a depth of four feet (the greatest depth sampled) in some areas. In addition, dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethane (DDD), and dichlorodiphenylethane (DDE) were detected in one groundwater sample. This sample was taken from a well in a wet area where contaminants in surface water runoff may have migrated vertically through vadose zone soils. This, rather than direct migration through groundwater, may have been the mechanism for contaminant transport to this well.

RI field activities involved evaluation/rehabilitation of the existing IR monitoring wells located at the site. Other activities included a geophysical and ground-surface radiological characterization of the site. Sampling included groundwater of new and existing monitoring wells, surface water and sediment sampling, and soil sampling. The Draft RI report was submitted in September 1995.

After the results of the Draft RI were reviewed, it was determined that additional groundwater sampling was needed at the well exhibiting the highest concentrations and frequency of pesticide concentration, well GW 25-31. This was performed during the continuation of field activities between June 1996 and January 1997. One pesticide was detected in this well in an unfiltered sample; however, it was not detected in the associated filtered sample.

In mid-1995, a literature search was conducted to provide a preliminary indication of the potential to apply bioremediation technology to the pesticide-contaminated soils at Site 25. As a result of this literature search, bioremediation was considered a viable alternative for remediation, and a recommendation for further investigation was issued (B&R Environmental, 1996b). The technologies involved the use of indigenous bacterial populations in an aerobic cycle process, a slurry system with inoculation, an inoculated system with chemical oxidation, and the use of white rot fungus. The results of the bench-scale testing produced destruction efficiencies on the order of 30 to 65 percent (B&R Environmental, 1996b). The tests were unable to achieve anticipated treatment goals for the pesticide-contaminated soils.

It was hypothesized that because the pesticides were present in the soil matrix for a long duration, they were bound tightly to the soil particles and might not be available for ecological receptors. By determining the amounts of pesticides in the soil that were biologically available to organisms (earthworms) and by determining a bioaccumulation concentration, bioaccumulation studies were used to provide an understanding of the limits of bioremediation treatment processes, and were used in conjunction with food-chain modeling to develop site-specific ecologically-based PRGs (B&R Environmental, 1997). A bioaccumulation study was performed on DDT- and dieldrin-impacted soils collected from Site 25 to establish site-specific bioaccumulation factors. The study involved exposing earthworms to site soils for a four-week duration and then analyzing the pesticide content of their tissue. The pesticide content of the tissue was compared with the pesticide content of the soil to determine the bioaccumulation factors. Bioaccumulation factors were established for target compounds over a range of concentrations in both aged and freshly spiked soils. A Final Report (RETEC, 1998) was issued.

An Addendum RI/FS was submitted in July 1999. As part of the FS, additional surface soil, subsurface soil, and groundwater sampling was performed in December 1998. Soil sampling efforts concentrated on the areas with the heaviest suspected contamination as well as those outlying areas for which no data was previously available from the 1994 RI. The major conclusions from the 1998 sampling event were as follows: 1) no contamination exists in the French Drain Area below a depth of four feet; 2) negligible pesticide and metals were found in the groundwater; 3) while several pesticide “hot spots” were found in the surface soil throughout the site, no pesticide PRGs were exceeded at depths of two feet or greater; and 4) exceedances of dioxin/furan and metals PRGs were infrequent, random throughout the site, and typically not within the source area.

For Site 25, the selected remedy consisted of excavation and offsite disposal of contaminated soils, consistent with the Navy strategy to reduce risks at the sites with minimal long-term care. In order to protect potential ecological and human receptors from soils contaminated with pesticides and inorganic constituents, contaminated soil at levels exceeding RAOs were to be excavated. The excavated areas were to be backfilled and revegetated and the wetlands restored. The RAOs for the COCs are presented in Table 2-4.

A PRAP and public notice were issued announcing the public comment period starting July 21, 1999 to August 19, 1999. No written comments were received during the 30-day public comment period. A public meeting was held on July 28, 1999 to present the Proposed Plan for Site 25. The Navy and USEPA signed a ROD in September 1999, with VDEQ issuing a concurrence letter (U.S. Navy, 1999h).

TABLE 2-4

**SITE 25, REMEDIAL ACTION OBJECTIVES
NSF DAHLGREN**

Contaminant	Concentration
Human Health	
Dieldrin	0.67 mg/kg
Antimony	18.0 mg/kg
Ecological	
4,4'-DDT-R	1.0 mg/kg
Dieldrin	1.0 mg/kg
Antimony	5.0 mg/kg
Lead	50 mg/kg
Mercury	0.10 mg/kg
Silver	2.0 mg/kg

The final Remedial Design, submitted in May 2001, consisted of several major components: 1) excavation of pesticide- and metal-contaminated soil; 2) offsite disposal of the contaminated soil; 3) construction of a storm water culvert to divert the Cooling Pond discharge across the restored and newly created Site 25 wetlands; 4) excavation for the purpose of wetlands expansion; and 5) planting of natural wetland vegetation. Revisions to the Cooling Pond outlet structure were reflected in the revised final Remedial Design, submitted in July 2001. The remedial action construction was completed in December 2001 (TtNUS, 2001d).

Wetland monitoring of Site 25, which includes two semi-annual inspections of each wetland mitigation project area, began in Fall 2003. At a meeting with EPA BTAG in February 2006, it was decided that due to the successful establishment of wetland vegetation and starting in Spring 2006, the quantitative evaluation of vegetation can be replaced with a qualitative evaluation. The qualitative evaluations should address whether any live Phragmites remains and identify any visible problems related to pests, herbivores, erosion or other factors. The Spring 2006 monitoring event was conducted in April 2006 and the Fall monitoring event in October 2006. The only significant finding was the presence of small patches of phragmites, which was still present despite being treated in October 2005 as part of a base-wide control program. It is recommended that all phragmites that survived the 2005 herbicide treatment should be retreated in Fall 2007 and annually thereafter until successfully eradicated.

The 2007 wetland inspections were conducted on May 8, 2007 and November 8, 2007. The Draft 2007 Annual Wetland Monitoring Report was submitted January 2008. EPA BTAG comments regarding the report were received May 2008. Observations throughout the five-years of monitoring suggest that the entire area has been successfully converted into non-tidal wetlands. The continued presence of Phragmites was noted during the monitoring. Recommendations were made to continue the herbicide treatments until phragmites are eradicated. In addition, the saplings that were mowed down along the edge of the wetland area should be replanted to restore the woody vegetation. The next round of wetland monitoring is scheduled for June 2008.

Based on comments received by EPA BTAG on the FY 2003 Wetlands Monitoring Report (JMWA, 2004a), it was decided that benthic macroinvertebrate sampling should be conducted to ensure that a diverse community of benthic macroinvertebrates which displays ecological functions typical of similar natural wetlands is developing in the sediment of the wetlands at Site 25. The first benthic macroinvertebrate sampling event took place on May 18, 2005 and the findings were:

- Abundant number of organisms but no overwhelmingly dominant taxon
- Largest number of organisms are Physa gyrina, a small freshwater snail
- Fair diversity
- High pollution tolerance

BTAG concluded that additional sampling is necessary before any meaningful conclusions can be drawn. They also suggested that a greater sample size (more than 2 samples per wetland) would be needed to generate sufficient data to quantitatively evaluate the development of an adequate benthic macroinvertebrate community.

A round of benthic macroinvertebrate monitoring took place in July 2007. Results from the investigation did not determine the reasons for the decline in taxonomic diversity from 10 taxa in 2005 to 3 taxa in 2007. The sampling team had to physically cut back and break the soil collected from the Site 25 wetland to loosen it from a dense network of terrestrial plant roots. This action may have dislodged many benthic organisms from the sampled material, thereby artificially depressing the number of collected organisms. It was recommended at least two additional years of data would be necessary to determine whether the decline is a meaningful trend. The next round of benthic sampling is scheduled for June 2009.

SITE 29 - Battery Service Area

The Battery Service Area (known as USEPA SWMU 79) is located in the south-central portion of the Mainside. Analysis of historical aerial photographs indicates that a concrete building, a bunker, and open service yard areas, all of which were serviced by a road, were located in the present-day Battery Service Area as early as 1937. Evidence of what appears to have been a disposal pit was noted in the 1952 imagery and continued to be visible in the photography as late as 1977.

The IAS reports that waste battery acids were discharged into an underground tank at the Battery Service Area, a practice that was still in effect during an onsite survey in 1982 and which continued until 1985. The tank was never reported to be emptied. Approximately 10 to 15 gallons of battery acid per month were reportedly disposed of in this manner.

During a site reconnaissance conducted in March 1989, the results of a dye test indicated there is no tank present at this site. Rather, the disposal area consisted of a pit filled to within two feet of the ground surface with limestone, likely to neutralize the acid. When the site reconnaissance was completed, the pit was not backfilled, although the manhole was covered with soil. Waste acid is currently placed in a 50-gallon tank to await removal by a waste disposal contractor. The tank is filled about three times per year. Based on current use, the historic disposal rate into the limestone was estimated to be about 150 gallons per year.

As part of the IR Program, numerous monitoring wells have been installed in the vicinity of the Battery Service Area. Based on a review of existing well locations and construction details, one upgradient and one downgradient monitoring well have been included for groundwater monitoring at the site.

Confirmation sampling was not conducted at this site. RI field activities involved evaluation/rehabilitation of the existing IR monitoring wells located at the site. Field activities also included groundwater sampling of new and existing monitoring wells and soil sampling. These activities were completed in March 1994. The Draft RI report was submitted in September 1995.

After the results of the Draft RI were reviewed, it was determined that the neutralization pit would be excavated to verify the pit as the source area and to obtain additional samples. This work was performed between June 1996 and January 1997. Soil samples were taken in the pit to identify the concentration of contaminants and provide waste characterization for disposal purposes. During the excavation, the concrete pipe and a portion of the limestone/gravel fill were placed in a roll-off box for disposal off-site. High vapor concentrations during excavation prevented removal of all of the backfill. As a result, the excavation was halted and the pit was backfilled with compacted crusher run gravel.

An EE/CA was prepared and finalized in May 1997 (U.S. Navy, 1997a). The EE/CA recommended a Removal Action, which was performed between July and October 1997. This involved removing the unlined neutralization pit and approximately 200 cubic yards (CY) of petroleum hydrocarbon- and metals-contaminated soils. Due to the low metals concentrations, the excavated soil was classified as non-hazardous. The resulting excavation measured 21.5 feet by 38 feet by approximately 7 feet deep. During excavation of the contaminated soils, the contractor exposed a 550-gallon steel underground storage tank. The NSF Dahlgren personnel removed the petroleum-related product remaining in the tank. The contractor shipped the product to an offsite fuel recycling facility. The tank was cleaned, rendered useless, and shipped offsite to a metal recycling facility (OHM Remediation Services Corp., 1998).

The RI/FS Addendum was finalized in July 1999. The RI/FS indicated metals were the only contaminants in the soil media that warranted remedial action. Sampling data was presented to verify the removal action had achieved its objectives. The revised risk assessment for soil indicated the remaining risks are acceptable, and the RI/FS recommended that no further action be taken for soils at Site 29. Groundwater risks are acceptable although they are at the upper end of the acceptable limit. The pattern of metals detected in shallow groundwater at Site 29 indicates metal concentrations are attributable to naturally occurring conditions and not attributable to Site 29. A PRAP and public notice were issued announcing the public comment period starting July 21, 1999 and ending August 19, 1999. A ROD was signed by the Navy and USEPA in September 1999 indicating no further action was necessary at Site 29. VDEQ issued a letter concurring with the ROD (U.S. Navy, 1999g).

SITE 44 - Rocket Motor Pit

The Rocket Motor Pit (known as USEPA SWMU 41) is located next to the Ordnance Burn Structure (Site 3), north and west of Caskey Road in the central part of Mainside. It is approximately 24 feet by 36 feet, with a depth of approximately 5 feet. The facility applied for a RCRA permit to operate the site but operated under interim status until September 1994 when the site was closed.

The Rocket Motor Pit was in use since the early 1960s to anchor waste rocket motors while they were burned. The sides of the unit are constructed of 0.5-inch thick steel plates and the ends are constructed of 4.5-inch thick steel plates. The bottom of the pit is not lined. The pit is equipped with a 4.5-foot interior dimension steel tube, approximately 15 feet and 10 inches long. The tube walls consist of 4- to 5-inch thick steel. The tube was used for burning the rocket motors. A 3-inch support bar was used to raise and lower the motors. During operations, a rocket motor was placed in the cylinder, ignited, and burned. The steel structures were removed from the site for research and development reuse at the Pumpkin Neck Area of the NSF Dahlgren during December 1997 through January 1998 (B&R Environmental, 1998a).

Wastes associated with Site 3 were burned at Site 44 and may have included RCRA listed hazardous wastes and characteristic reactive wastes. No estimate of the total quantity of material treated at this site has been prepared. The wastes may have included the following (B&R Environmental, 1998a):

- Wastewater treatment sludges from the processing of explosives,
- Spent carbon from the treatment of wastewater containing explosives,

- Rocket motors,
- Explosive powder, and
- Other ordnance-related items.

The OB unit at Site 44 was closed in a manner that eliminated the need for post-closure care. An EE/CA, completed in May 1998 (TtNUS, 1998), contains closure plan requirements designed to achieve clean closure performance standards as described in 9VAC-20-60-580B. As part of the final design for this removal action, an investigation of soil contamination at the site was conducted in 1997. Limited organic and inorganic contamination was identified during the investigation. Inorganic contamination above RBCs included arsenic, iron, aluminum, nickel, manganese, chromium, and vanadium. Limited organic contamination was identified including dioxins, semi-volatile organic compounds, and explosives. No compound was detected above its respective RBC (B&R Environmental, 1998a). The removal action of contaminated soils was completed in 1998.

A groundwater monitoring plan was implemented to address any potential groundwater contamination. Quarterly groundwater sampling was conducted to meet Virginia Hazardous Waste Management Regulations. A total of four quarters of monitoring is required to establish background levels for comparison with point of compliance. The first quarter sampling was conducted in August 1996, the second quarter in November 1996, the third quarter in October 1997, and the fourth quarter in March 1998. An Annual Groundwater Report, submitted in November 1998, summarizes the quarterly results and reviews the statistical significance of the data. The following items were noted in the Annual Report when comparing statistically significant constituents with MCLs and RBCs for tap water:

- When comparing the maximum detected concentration of statistically significant constituents with MCLs, cadmium was the only constituent that exceeded the MCL. However, the cadmium concentration was less than its associated RBC.

- When comparing the maximum detected concentration of statistically significant constituents with RBCs; RDX, arsenic, gross alpha, and gross beta were the only constituents that exceeded the RBCs. However, for each of these constituents except RDX, the concentrations were less than the associated MCL.

- The only statistically significant constituents that did not have an MCL or RBC were 2-amino-4,4-dinitrotoluene and 4-amino-2,6-dinitrotoluene.

An RI/FFS was prepared for the combined Sites 3 and 44 due to their relatively close locations and both sites were used to perform similar types of operations. The RI/FFS was performed to document the nature and extent of contamination and evaluate the removal action and groundwater monitoring. In addition, it provided the RCRA closure plan for groundwater at Site 3 and Site 44. The U.S. Navy, USEPA Region III, and VDEQ finalized the RI/FFS in July 2000 (TtNUS, 2000a). This report indicated that “no further action” was warranted for soils. The human health risk assessment for exposure to groundwater indicated risks are unacceptable. However, Site 3 and Site 44 are not considered to be the source of groundwater COC, 1,1,1-TCA, 1,1-DCE, and arsenic. 1,1-DCE and 1,1,1-TCA concentrations in downgradient wells were less than concentrations detected in upgradient wells. Site 12 has been identified as the source of these contaminants and is currently being remediated. Arsenic concentrations in downgradient wells were only slightly less than concentrations detected in the upgradient wells and are attributable to naturally occurring conditions.

A PRAP was prepared for Site 3 and Site 44 recommending that no further action be taken at this site (U.S. Navy, 2000a). The PRAP and a public notice were issued announcing the public comment period starting July 20, 2000 and ending August 19, 2000. No comments were received during the 30-day public comment period or at the Public Meeting held on August 9, 2000. The Navy and USEPA signed a ROD in September 2000, with VDEQ issuing a concurrence letter (U.S. Navy, 2000c).

SITE 58 - Building 1350 Landfill

The Building 1350 Landfill (known as USEPA SWMU 134) is located on Mainside adjacent to Kennel Road and extends down into Gambo Creek. The site is an extension of the Disposal Burn Area (Site 9) and was in use during the same period as the Disposal Burn Area (from the 1940s to 1970s). This site contained the following items: 55-gallon drums of roofing tar, 5-gallon and 1-gallon paint cans, railroad ties, roofing shingles, and miscellaneous steel and concrete debris. The area has a moderate to heavy vegetative cover. Surface water flows directly into Gambo Creek or into a drainage area on the south end of the site and subsequently into Gambo Creek.

RI field activities included the installation of one groundwater well at the center of the Site 58 landfill. A soil boring sample was taken at the well location. In addition, surface soil and surface water and sediment sampling were conducted on the site and in Gambo Creek, respectively. This fieldwork was conducted between June 1996 and January 1997. This site was incorporated into the Site 9 RI/FS, PRAP, and ROD (U.S. Navy, 1998a).

A Final Closure Design for Site 9 (which included Site 58) was completed in February 1999. The Remedial Action to remove debris at Site 58 and transfer it to Site 9 started in March 1999 and was completed in June 1999. A Final Closure Report for Site 9 was submitted in November 2000 (OHM Remediation Services Corp., 2000). The Closure Report documents the construction process and describes the activities that were performed in executing the closure of the landfill, marsh areas, and Site 58. The Long-Term Monitoring Plan for Site 58 is included with the plan for Site 9 as is the Wetlands Mitigation Monitoring Plan (TtNUS, 2001). The Five-Year Review for Site 58 was included with the Five-Year Review Report for Site 9, which was completed in December 2004 (JMWA 2004d).

Due to its upgradient proximity to Site 9, all monitoring activities (groundwater, surface water and sediment, etc.) that may involve Site 58 are included in the Site 9 section of this document.

2.2 PRIORITY 1 SITES

SITE 6 - Terminal Range Airplane Park

The Terminal Range Airplane Park (known as USEPA SWMU 54) is located on the southern bank of Gambo Creek at Mainside. The area is U-shaped, approximately three acres in size, and well vegetated with grass, except for a gravel-and-dirt driveway. A locked gate and the woods surrounding the site limit vehicular access to the area.

The Terminal Range Airplane Park was used since the 1940s to store scrap metallic items such as empty drums, inactive airplanes, and steel personnel and camera shelters; items waiting testing; drums of gun barrel preservative product; sandblasting agent product; railroad ties and telephone poles. Sampling results indicated that the preservative product in the drums did not contain PCBs. All drums were removed in the Fall of 1992.

A SSP investigation, Priority 1 Sites (B&R Environmental, 1996a) was performed for this site. Contaminants of concern at the site included PAHs, PCBs, and elevated metals. The report recommended proceeding to the RI/FS process.

An RI work plan was finalized in December 1996 and RI field activities were initiated in January 1997. Groundwater, surface soil, subsurface soil, and sediment sampling were conducted. These samples were collected to determine the extent of metals, PAHs, and PCB contamination in the soils, surface water, sediment, and groundwater, and to assess the impacts in a human health and ecological risk assessment.

Site 6 occupies a topographically high area bordered to the north by a marshy tributary of Gambo Creek. The land slopes in a semi-radial pattern toward the surrounding marsh. Surface runoff from the site flows either into an east or west drainage area and then into the marsh or directly into the marsh. Shallow groundwater flows within a fine grained matrix with a high natural organic material content. Groundwater flow generally mimics topography and discharges in the marsh north of the site.

VOCs were not detected during the SSP sampling event or were found at insignificant concentrations as determined by a conservative screening evaluation; therefore, they were dropped from analysis in the RI. Many of the environmentally significant compounds detected at Site 6 included SVOCs, pesticides, and metals. Significant contaminant migration is not evident at the site. The greatest impacts are apparent in surface soils located within the site boundary. Transport of contaminants or soil particles with adsorbed contaminants is evident in the marsh. However, the effects diminish rapidly while moving away from the marsh shoreline. The Draft RI (Priority 1 sites) recommendations included the following:

- Conduct an additional round of groundwater sampling, using low-flow sampling techniques, to determine mobile metal concentrations in the water table aquifer. This data may be used to reevaluate the risk via ingestion of groundwater to determine whether deed restrictions must be included in a ROD governing groundwater usage.

- Conduct an exploratory trenching operation to determine the precise nature of the fill material and provide dimensions on the extent of fill to support an FS.

A FFS Priority 1 Sites Project Plan was submitted for review. This Project Plan detailed additional fieldwork, which augmented previously collected data to ensure that appropriate remedial alternatives are developed and evaluated. Trenching activities were conducted at Site 6 in July 2000 to determine whether waste material was present in the subsurface soils due to historical filling and regrading of the site. Additionally, surface soil, sediment, and surface water samples were collected. Sediment/surface water samples were intended to help evaluate remedial alternatives for the sediment hot spot around sample location SD54-3. Surface soil sampling was conducted to fully delineate horizontal and vertical surface transport pathways.

A FS was prepared and completed in January 2002 to provide remedial action alternatives for Site 6. A PRAP was prepared for the complete excavation with offsite disposal of buried wastes and contaminated soils and wetland restoration. The PRAP and a public notice were issued announcing the public comment period starting January 23, 2002 and ending February 22, 2002. The Navy and USEPA signed the Site 6 ROD in September 2002, with VDEQ issuing a concurrence letter (U.S. Navy, 2002f). The Final Closure Design was submitted in June 2002. Site restoration was completed in July 2004.

During excavation, approximately 20,000 tons of contaminated sediment were removed from Site 6. Materials were shipped off-site for disposal include 14.3 tons of sediment/ liquid from storm drain cleaning, 480 CY of railroad tie timbers, 30,000 tons of non-hazardous soil and sediment, and 25 CY of miscellaneous drums and debris. In addition, approximately half a 55-gallon drum of 20 and 40 mm explosive rounds were recovered during excavation.

During construction, two major challenges were met and solved. An amphibious buggy with large air-filled wheels was used to till sandy clay into a marsh where other equipment would have been prone to sinking. The team was also concerned about upgradient storm water runoff through the wetland during excavation. A pump-around system was used to divert upgradient storm water around the site to minimize erosion and stabilize water levels in the excavated areas. To fill the excavated areas, an onsite borrow area was generated, which created approximately 0.9 acres of new wetland (TtNUS, 2005h). This new wetland was used to offset wetland losses from other IR sites. Site remediation was completed in July 2004.

As part of the supplemental Gambo Creek Ecological Assessment, sediment samples were collected in the lower reaches of Gambo Creek in order to fill in data gaps previously identified in the Phase II Gambo Creek EA (TtNUS 2003). Sediment sample location GC-58 was located in the marsh area just upstream and east of Site 6. This sample area was located in an area that was previously identified in the Phase II Gambo Creek EA as having concentrations of manganese above the EC. In October 2006, manganese once again exceeded its EC of 563 mg/kg at sample location GC-58 (666mg/kg). The absence of manganese in upstream samples GC-56 and GC-57, and in downstream sample GC-59 at levels greater than the EC and therefore appears to indicate that the elevated manganese concentration in GC-58 is most likely associated with Site 6.

Wetland monitoring of Site 6, which includes two semi-annual inspections per year, did not begin until October 2004 because the wetlands portion of the project was not completed until Spring 2004. The 2006 observations suggest that the entire wetland, established as the mitigation wetland area has been successfully converted into a tidal wetland that is developing a diverse stand of indigenous vegetation with plant species called for in the design. Phragmites was observed in the Main area and Marsh Cove, despite being treated in October 2005 as part of a base-wide control program. It was recommended that phragmites continue to be treated annually until successfully eradicated at the site. Cattail was observed primarily in the Marsh Cove, and although its coverage has increased by approximately 10 percent compared to the 2005 monitoring event, it was decided that since cattail is a native species eradication is not necessary as long as a diversity of wetlands vegetation persists.

The 2007 wetland inspections were conducted on July 19, 2007 and November 7, 2007. The Draft 2007 Annual Wetland Monitoring Report was submitted January 2008. EPA BTAG comments regarding the report were received May 2008. Observations suggest that the entire Main Area, Marsh Cove and Bowl areas have been successfully established. Site 6 wetlands were treated with a herbicide in late October 2007. Any new growth should be retreated in September 2008 and annually thereafter until successfully eradicated. The next round of wetland monitoring is scheduled for June 2008.

Based on comments received by EPA BTAG on the FY 2003 Wetlands Monitoring Report, benthic macroinvertebrate sampling will be conducted to ensure that native ecological systems are developing in the wetlands at Site 6. The BTAG suggested that a greater sample size (more than 2 samples per wetland) would be needed to generate sufficient data to quantitatively evaluate the development of an adequate benthic community.

The benthic macroinvertebrate monitoring was scheduled for June 2007, but was delayed due to the presence of an active bald eagle's nest. The benthic macroinvertebrate monitoring took place in July 2007. Results from the sampling indicated that the wetlands constructed in the Main Wetland and Marsh Cove area have developed a viable benthic community. The BTAG concluded that additional sampling is necessary before any meaningful conclusions can be drawn. The next round of benthic monitoring is scheduled for June 2009.

SITE 21 - Gun Barrel Decoppering Area

The Gun Barrel Decoppering Area (known as USEPA SWMU 52) is located west of Building 235, at Mainside. It includes two decoppering sites, a large tank on an inactive railroad track bed, and a smaller trough near the edge of the loading dock for the railroad tracks. The larger tank was used to decopper cases and the smaller trough was used to decopper gun barrels. Gun barrels were washed with sulfuric and chromic acid in the trough to remove built-up residues from repeated use. The barrels were then lifted out of the acid bath and allowed to drain directly onto the ground and into the rail track trench. The residues were primarily copper but also included lead, brass, and tin. It is not known where the acid used in the decoppering process was disposed of.

The larger site (tank) is essentially a box made of 1/2-inch-thick steel. It measures approximately 13 feet wide, 18 feet long, and 6 feet deep and is covered by a metal grate. The tank operated from 1971 until the early 1980s. The tank is located in a railroad trench. A known one-time release of waste acid from the site to the gravel of the railroad track bed occurred between 1970 and 1975. A bluish-green tint on the gravel and on the sides on the concrete railroad loading dock next to the site was noted. The color did not appear to be attributable to algae or other plant growth. This color may be indicative of chromic acid or copper precipitate. The tank was decontaminated and removed in April 1995.

The smaller site (trough) is essentially a steel trough, lined with lead. It measures approximately 2 feet wide, 24 feet long, and 2 feet deep. The trough was used from the early or mid-1960s to the early 1970s and was located on a concrete pad. During the Navy Site Visit, a bluish-green tint of the concrete at the eastern end of the site was noted. The color did not appear to be attributable to algae or other plant growth. This color may be indicative of chromic acid or copper precipitate. The trough was removed in August 1995.

A SSP investigation, Priority 1 Sites (B&R Environmental, 1996a) was performed on Site 21. The report recommended that soil in the vicinity of the railroad tracks and loading platform be identified for a removal action under CERCLA.

An EE/CA was completed for this site to evaluate alternatives for a removal action. The report recommended removing the contaminated soil and debris to the target soil cleanup levels and removing any surficial contamination on the concrete platform.

A removal action was performed at the site between July and October 1997. Prior to mobilization, a representative sample of the soils was collected and shipped offsite for disposal analysis. Due to low concentrations of arsenic, chromium, and other metals, the soil was classified as non-hazardous. The contractor removed railroad ties from the surface of the abandoned rail bed and excavated approximately 370 CY of arsenic- and chromium-contaminated soil. The resulting excavation measured 12 to 16 feet wide, 130 feet long, and 5½ feet deep. Excavated soil was direct-loaded into waiting dump trucks. Railroad ties were shipped offsite for disposal as non-hazardous construction and demolition debris. Surficial contamination on the concrete platform was steam cleaned. A final report was submitted in October 1998 (OHM Remediation Services Corp., 1998).

The remaining soil and groundwater at Site 21 were evaluated in a Site Decision Document. Based on the contents of the September 2002 Site Decision Document, it was the consensus of the Remedial Program Managers (RPM) that this site required no further action under a residential use scenario under CERCLA (U.S. Navy, 2002g).

SITE 22 - Gun Barrel Degreasing Area, North Main Range

The Gun Barrel Degreasing Area, North Main Range (known as USEPA SWMU 53) is outside Building 207 and west of Building 235 at Mainside. The degreasing area location at the site has shifted through time. Site 22 has been used as a location to store and degrease 5-inch and 76-millimeter gun barrels. Initially, gun barrels were degreased via steam cleaning over the concrete pad covering the area, without secondary containment. Beginning in the early 1980s, the aboveground site consisted of a steel degreaser tank holding approximately 1,200 gallons and measuring approximately 6 feet wide, 20 feet long, and 4 feet deep; an aboveground steel kerosene (solvent) storage tank holding approximately 2,000 gallons, with secondary containment; and two steel 55-gallon drums for storing solid wastes associated with the degreasing process.

In 1993, an aluminum lid was built for the degreaser tank to prevent precipitation from entering the tank. Prior to that, precipitation runoff was routed to a steel trough, which was removed in May 1993. The steel trough routed the runoff to an oil/water separator (OWS) 207-300 (Site 53, also removed in 1993) and then to the storm drainage system. In 1992, the width of the degreaser tank was reduced by half.

The tar-like preservative inside gun barrels at the Gun Barrel Degreasing Area, North Main Range was removed using kerosene. Used kerosene is pumped to an aboveground storage tank, and kerosene in the tank is sampled for metals prior to being pumped out of the tank and sent offsite for recycling. The degreasing process generates approximately one full-tank of used kerosene and four to five drums of solvent- and preservative-contaminated solid wastes (rags, etc.) each year. Until the mid-1980s, mineral spirits (e.g., dry-cleaning solvent) were used as a solvent as well.

A SSP investigation, Priority 1 Sites (B&R Environmental, 1996a) was performed on the site. The report recommended that additional sampling be performed in the drainage ditch to confirm remaining contaminant concentrations following previous soil removal activities (1985) at the site. If sampling results indicated little or no contamination, then no further action would be required. An EE/CA was completed for this site documenting the need for confirmation sampling and possible further excavation.

A removal action was conducted at Site 22 between July and October 1997. The contractor used a track excavator to remove approximately 15 CY of petroleum hydrocarbon-contaminated soil from each of the two locations. The contractor placed backfill into the holes once the final confirmation samples met removal action goals. A final report was submitted in October 1998 (OHM Remediation Services Corp, 1998).

Confirmation sampling results of the remaining soil and groundwater at Site 22 were evaluated in a Site Decision Document. Based on the contents of the September 2002 Site Decision Document, it was the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA (U.S. Navy, 2002g).

SITE 31 - Airplane Park Dump, EEA

The Airplane Park Dump (known as USEPA SWMU 6) is located in the northwest part of the EEA adjacent to Upper Machodoc Creek, east of Wood Island. The site presently consists of a heavily wooded area and is approximately two acres in size.

The Airplane Park Dump was used from the late 1940s until the late 1970s. The site consists of a ravine and a trench. The ravine was backfilled with solid wastes such as old aircraft and aircraft parts, scrap metal, waste explosive containers, electronic equipment, wood and plastic shipping containers, trash, wood railroad ties, and possibly small electrical transformers. The dump area is 20 to 30 feet deep. The ravine empties into Upper Machodoc Creek, and as a result solid wastes from the dump were also released into the creek. In addition to the ravine, a trench was dug at an unknown time for the purpose of dumping scrap metal, timber, and other solid wastes.

A silt fence was installed at the mouth of the ravine to slow erosion of soil from the site. A white, powdery-looking fungus was analyzed and identified as being normal to the shady conditions of the area, its growth possibly encouraged by decomposition of trash in the dump.

A SSP investigation, Priority 1 Sites (B&R Environmental, 1996a) was performed on the site. The report indicated elevated metals concentrations in surface soils and groundwater. The source of these constituents appeared to be the debris disposed of in the site’s drainage areas. Ordnance was also considered potentially buried at the site; however, explosive compounds were not detected during sampling. The recommended action at this site was to proceed to an RI to determine the potential human health risks and ecological impacts of metals possibly discharging to the surface water/sediment in Upper Machodoc Creek from the groundwater.

The RI work plan was finalized in December 1996 and field activities were initiated in January 1997. Groundwater, surface soil, subsurface soil, sediment, surface water, and macroinvertebrate sampling was performed. These samples were collected to determine the ecological impact from metals discharging into Upper Machodoc Creek by providing data for an ecological and human health risk assessment.

During the SSP sampling event, VOCs, SVOCs, PCBs, and pesticides were not detected and were subsequently dropped from the analytical scheme completed during the RI investigation, except where data gaps necessitated verification that these constituents were not present at concentrations of concern. Various metals were found to be the primary constituents released from Site 31. Random distributions of inorganic compounds were found, as may be expected in a heterogeneous fill area. No specific hot spots were identified. The Draft RI (Priority 1 Sites) recommendations included the following:

- Conduct an additional round of groundwater sampling, using low-flow sampling techniques, to determine mobile metal concentrations in the water table aquifer. This data may be used to reevaluate the risk via ingestion of groundwater to determine whether institutional controls must be included in a ROD addressing groundwater usage.

- Conduct an exploratory trenching operation to determine the precise nature of the fill material and to provide dimensions on the extent of fill to support an FS.

Site 31 was included in a Draft FFS Priority 1 Sites Project Plan (March 2000). The plan detailed additional field work required to augment previously collected data to ensure that appropriate remedial alternatives would be developed and evaluated. Trenching activities were to be conducted at Site 31 to determine whether waste must be removed to achieve setback and other requirements for waste disposal areas. Data gathered from groundwater sampling were intended to determine mobile metal concentrations in the water table aquifer. Soil sampling was conducted to help delineate the horizontal and vertical extent of waste.

An EE/CA for Site 31, finalized in March 2001, presented results of the trenching operations and sampling effort, and presented an analysis of alternatives (TtNUS, 2001b). The following summarizes the results of the EE/CA:

- The trenches revealed waste materials including plastic bags of household/kitchen waste, construction debris, soda cans, glass bottles, metal rods, metal powder boxes, ammunition containers, metal plates, wires, batteries, banding material, Styrofoam, aircraft parts, spent incendiary grenades, wood debris, empty and unlabeled 55-gallon drums, incendiary grenade caps, grenade containers, metal “I” beams, a torpedo part, and a small unlabeled cylinder containing a liquid. Additionally, small pockets of a whitish-blue powder were observed, analyzed, and determined not to be explosive or reactive. The trenching effort was halted because of the presence of live torpedo fuses near the ground surface and within the tracks of the excavation equipment.

- A qualitative risk assessment addressing both human health and ecological receptors was performed to identify whether risks associated with site-related constituents warranted remedial action. Iron and thallium were identified and posed potential risks for human receptors under a residential groundwater use scenario. The results of the ecological risk assessment indicated the potential for risks was primarily from metals.

- Site 31 sampling data indicate contaminant releases have occurred.

Based on the trenching operations and consideration of the sampling data, the EE/CA recommended the excavation and offsite disposal of 3,120 CY of contaminated soil and waste at Site 31. The public comment period for the proposed removal action occurred between March 7, 2001 and April 5, 2001. No comments were received during the public comment period and the removal action was initiated in April, 2001. The removal action was completed at the site in November 2001.

A RI/FS for Site 31 was completed in July 2003. The primary source of contamination was removed from Site 31. Risk assessments were performed using the data collected from the areas where soil and sediment remained at the site. The human health risk assessment determined that no potential health hazards are associated with exposure to soil and ambient air at Site 31, but there are risks related to exposure to fish tissue and groundwater. However, the risks for groundwater are driven by arsenic, iron, and manganese, which occur naturally or are within regional background levels at the site. Therefore, it is unlikely that concentrations of these metals are a result of past activities conducted at the site. Also, the uncertainties associated with risks from fish tissue derived from historical surface water data are likely to overestimate the risks from fish tissue exposure. The ecological screening risk assessment indicated a potential risk from exposure to metals, PAHs, pesticides, phthalates, phenols, and explosives in soil, sediment, surface water, and groundwater. However, it also indicated that these risks do not warrant remedial actions when considering spatial distribution, background concentrations, bioavailability, and food chain modeling. Based on the conclusions of the RI/FS, no unacceptable human health or ecological risks were found. A No Further Action ROD was signed on September 29, 2003.

SITE 32 - Fast Cook-Off Pit and Pond, EEA

The Fast Cook-Off Pit and Pond (known as USEPA AOC F) is located in the Research and Development section of Churchill Range in the EEA. The Fast Cook-Off Facility consists of a concrete burn pad and a water holding pond. This site began operation in the early 1980s. Operations at this site have ceased.

The pit, described as above ground, octagonal, and approximately 20 feet in diameter by 1 foot deep, was used to test munitions. It was constructed with a concrete bottom and steel walls. During testing, munitions were suspended over the pit by steel support structures, the pit was filled with water and jet fuel, and the fuel was ignited. Any runoff from this operation flowed into the associated containment pond. The containment pond was approximately 8 feet wide, 30 feet long, and 18 inches deep and had a poly-vinyl chloride (PVC) liner.

Site 32 is generally an open field with low topographic relief. Significant disturbances of the upper soil profile have limited vegetation growth, and much of the area is bare soil. The shallow groundwater table flows toward the east with the suspected discharge area, a marshy drainage of Black Marsh, located approximately 0.25 miles away.

A SSP investigation, Priority 1 Sites (B&R Environmental, 1996a) was performed on the site. An extensive investigation of soils was conducted during the SSP along with sampling of existing monitoring wells. The primary concern at the Fast Cook-off Pit was explosive compounds in the groundwater. Additional delineation was recommended to determine the extent of groundwater contamination. The report recommended proceeding to the RI/FS process; however, the 1996 report recommended that an ecological assessment should not be performed as part of that process due to the ongoing research and development activities at this site.

An RI work plan was finalized in December 1996. The RI field effort, concluded in January 1997, included groundwater sampling to determine the extent of explosives contamination in the groundwater and the need for groundwater monitoring on a regular basis. Groundwater was sampled from existing wells and from hydropunch locations to supplement the existing groundwater information. The primary constituents of concern at the site are explosive compounds, metals, and, to a much lesser degree, petroleum constituents. Contaminant distributions were fairly irregular and significant hot spots were not present.

A pilot bioremediation study was conducted from June 2002 through November 2002 at Site 32 to determine if various microbes could reduce concentrations of explosives in surface soils. The results indicated the presence of trace concentrations of trinitrotoluoene (TNT) and dinitrotoluene (DNT) compounds and much greater concentrations of HMX and RDX were identified in both the pre-treatment and post-treatment samples. The elevated post-application concentrations were attributed to active explosives testing, which continued during the course of the bioremediation test.

An RI/FS for Site 32, completed in March 2004, included human health and ecological risk assessments. The human health risk assessment indicated that potential adverse health effects may be associated with hypothetical future residential exposure to RDX in groundwater. However, the RDX is not attributable to former operations at Site 32, but to ongoing range and testing activities. The ecological risk assessment indicated that potential risks exist from exposure to metals, PAHs, phthalates, and explosives in the surface soil and groundwater. The ecological risk management analysis indicated these potential risks will continue to exist as long as Churchill Range remains active. Because of these continuing activities at the site, no further action is recommended at Site 32. At the time the range is closed, cleanup of Site 32, to address human health and ecological risks, will comply with all applicable federal and state laws and regulations. A No Further Action ROD has been completed for the site.

SITE 45 - July 28, 1992 Landfill B

The July 28, 1992 Landfill B (known as USEPA SWMU 45) is located west of Site 12, Chemical Burn Area, and east of Gambo Creek at Mainside. The unlined landfill was approximately 2.5 acres in size and wooded, with a moderate covering of fallen leaves.

The July 28, 1992 Landfill B received its name because of the date it was discovered. It was used from the 1960s to the early 1970s and consists of a drainage area that was filled in with solid wastes such as car tires, rusted-out cans, shingles, plumbing fixtures, construction rubble, pallets, and empty powder casings. Previously discarded items were visible at the landfill such as railroad ties, shingles, crumpled metal sheeting, a tire, porcelain plumbing appliances, and pieces of Styrofoam.

A SSP investigation, Priority 1 Sites (B&R Environmental, 1996a) was performed on the site. Based on the findings in the report, no significant contamination concerns were detected that would require further investigation. However, because solid waste remained on the site, (e.g., tires, metal cans, shingles, plumbing fixtures, construction debris, empty powder casings), a general site cleanup was performed. If suspicious materials or other visual evidence of contamination were uncovered during the site cleanup, samples were taken and proper disposal of the material was performed. USEPA Region III and VDEQ were informed of the progress and consulted if anything of concern was uncovered.

A general site cleanup was performed for Site 45 between July and September 1997. The objective was to remove surface debris located at several locations at the site. Prior to ground disturbance, an EOD contractor performed a reconnaissance of the areas to be disturbed. Ordnance was not encountered during either the reconnaissance or the removal actions. A track excavator was used to excavate partially buried debris encountered at the site. Topsoil was stripped and stockpiled for use during site restoration. The excavator and a front-end loader were used to consolidate and load the debris into dump trailers. Following debris removal, topsoil was regraded and seeded, and other disturbed areas were mulched to complete the site restoration.

Since no contamination was found at the site during the 1996 SSP investigation, no verification sampling was performed after site cleanup. Therefore, the soil and sediment samples from the Site 45 1996 SSP were re-evaluated in a Site Decision Document using the most recent version of the RBC tables. Based on the contents of the June 2002 Site Decision Document, it was the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA (U.S. Navy, 2002d).

SITE 46 - July 28, 1992 Landfill A: Stump Dump Road

The July 28, 1992 Landfill A: Stump Dump Road (known as USEPA SWMU 47) is located south of Stump Dump Road, adjacent to a tributary of Gambo Creek in the central part of Mainside. The site is approximately five acres and is located in a gently sloping area that directly intrudes into a marsh associated with a tributary of Gambo Creek. The area is fairly heavily vegetated with hummocky terrain, probably due to mounding and subsidence of fill areas. Surface water runoff either percolates into the soil or runs off directly into the marsh. Groundwater flow generally mimics the topography and flows through a fine grain matrix with abundant natural organic matter. The water table aquifer discharges directly into the adjacent marsh.

Filling activities were suspected to have occurred sometime prior to 1958 until around 1969 along the edge of Gambo Creek, according to an evaluation of aerial photographs. The waste reported included municipal waste, electrical components, construction debris such as shingles, and machine shop wastes such as metal shavings. Railroad ties also were present at the site and visible at the surface. During Fall 1992, four 55-gallon drums of tar were removed from the edge of the landfill and disposed of properly.

A SSP investigation, Priority 1 Sites (B&R Environmental, 1996a) was performed on the site. The report recommended proceeding to the RI/FS process.

The RI work plan was finalized in December 1996, and field activities were initiated in January 1997. Field activities included groundwater, surface soil, subsurface soil, surface water, and sediment sampling. Data from these samples was used in conjunction with data previously generated for Gambo Creek to perform ecological and human health risk assessments for this site.

VOCs were not detected in significant concentrations during the SSP and were subsequently eliminated from the analytical suite performed during the RI. Compounds detected at Site 46 included primarily metals, PAHs, pesticides and PCBs. These constituents were distributed randomly in the surface and subsurface soils at the site, as would be expected in a heterogeneous fill area. Contaminant migration had occurred to a minor degree into the marsh with the primary transport mechanism suspected to be impacted soil transport through erosion or tidal action. The compounds detected in the marsh might also have been the result of direct waste deposition, but the physical extent of the fill area had not been directly or completely defined.

The Site 46 RI was finalized in March 2001 (TtNUS, 2001a) and made the following recommendations to address data gaps and continue the CERCLA process at Site 46:

- Conduct an exploratory trenching operation to determine both the nature and extent of waste material. Specifically, the quantity of waste present in the marsh needed to be defined.

- Conduct an additional round of groundwater sampling, using low-flow sampling techniques, to determine mobile metal concentrations in the water table aquifer. This data was to be used to reevaluate the risk via ingestion of groundwater and to determine whether deed restrictions must be included in a ROD governing groundwater usage.

- Conduct an FS to evaluate potential remedial alternatives for metals and PAH compounds in soils and sediments. As part of the FS, resample the marsh surface water, with specific care devoted to minimizing suspended solids in samples, to determine more precisely what chemicals are present in the dissolved phase.

- Evaluate groundwater and overland flow paths through modeling to determine whether these transport mechanisms require remedial action and development of surface soil cleanup goals.

- Conduct Step 3A of the ecological risk assessment to better understand the level and extent of risk.

A FFS, Priority 1 Sites, Project Plan detailed additional fieldwork required which would augment previously collected data to ensure that appropriate remedial alternatives were developed and evaluated. Trenching activities were conducted in July 2000 to determine the location, nature, and volume of buried waste. Groundwater data were used to reevaluate the potential human health risks under the residential scenario. This data were used to reevaluate the risk via ingestion of groundwater. Groundwater samples were collected using a low-flow sampling methodology, which was expected to provide more representative samples than were collected during previous RI sampling.

An FS was completed to provide remedial action alternatives for Site 46. A PRAP was prepared for the complete excavation of buried wastes and contaminated soils with offsite disposal, and wetland restoration. The PRAP was advertised for public comment starting July 20, 2001 and ending August 20, 2001. No comments were received during the 30-day public comment period, or at the Public Meeting held on July 24, 2001. The Navy and USEPA signed a ROD in September 2001, with VDEQ issuing a concurrence letter (U.S. Navy, 2001c). The Final Closure Design was submitted in May 2002. A Final

Closure Work Plan was submitted in June 2002. The remedial action at Site 46 was completed in December 2002.

Wetland monitoring of Site 46, which includes two annual inspections of each wetland mitigation project area, began in Fall 2003. Results of the Spring and Fall 2006 monitoring may suggest that coverage by emergent vegetation is decreasing over time at the open water / wetland fringe. If subsequent monitoring events suggest that the fringe of emergent vegetation is progressively shrinking, and converting to open water, the need for action to prevent further ground subsidence might have to be considered. Phragmites at Site 46 was treated in October 2005 as part of a base-wide control program. While no phragmites was observed at Site 46 in 2006, some was observed in or on the edge of Gambo Creek, near the site.

The 2007 wetland inspections were conducted on May 9, 2007 and November 7, 2007. The Draft 2007 Annual Wetland Monitoring Report was submitted January 2008. EPA BTAG comments regarding the report were received May 2008. The tidal wetlands in Site 46 have consistently appeared to be more deeply inundated by the tides than anticipated by the design. If subsequent observations suggest that the fringe of emergent vegetation continues to recede, the need for action to prevent further grazing by animals and the development of open water might have to be considered. In addition, the loss of wetland vegetation versus open water expansion will continue to be documented. An inspection of the submerged aquatic vegetation (SAV) in the open water was conducted during the Fall 2007. SAV was estimated to occupy approximately 40 percent of the total pond area, with an estimated 20 percent being fully submerged, and an additional 20 percent being present at, or just below, the surface water. The next round of wetland monitoring is scheduled for June 2008.

Based on comments received by EPA BTAG on the FY 2003 Wetlands Monitoring Report, benthic macroinvertebrate sampling will be conducted to ensure that native ecological systems are developing in the wetlands at Site 46. The first benthic sampling event took place on May 18, 2005 and the BTAG concluded that additional sampling is necessary before any meaningful conclusions can be drawn. They also suggested that a greater sample size (more than 2 samples per wetland) would be needed to generate sufficient data to quantitatively evaluate the development of an adequate benthic community.

A round of benthic macroinvertebrate monitoring took place in July 2007. Results from the investigation suggested that the emergent wetland fringe separating the open water from the uplands at Site 46 supports a benthic community at least partially resembling those in adjoining area of undisturbed wetlands. The greatest concern for the overall success of the wetland restoration effort at Site 46 is the continuing shrinkage of emergent wetland and expansion of open water. The next round of benthic monitoring is scheduled for June 2009.

SITE 50 - Fill Area Northeast EEA

The Fill Area Northeast EEA (known as USEPA AOC X9) is located in the northeast corner of the EEA near Upper Machodoc Creek. The area, approximately three acres in size, is a fill area with no engineered construction and was in operation from the 1940s to 1955. Portions of partially buried World War II era aircraft (propeller planes) are visible in this area.

No information is available concerning the depth of the fill area. Visual estimates indicate that approximately 10 to 15 feet of fill was present. Based on a study of aerial photographs by the USEPA, evidence indicated buildings existed at this site since before 1937. Heavy use of the site began in 1944. Massive filling was underway, and a dock and new building were constructed. Filling was completed by 1952 and the buildings were removed in 1958. From 1962 to 1981, various ground scars and “light-toned materials” were reported. Four abandoned aircraft were parked at the site prior to removal in 1994, before the Phase 1 Geophysical Survey was conducted.

A SSP investigation, Priority 1 Sites (B&R Environmental, 1996a) was performed on the site. The constituents of concern (PAH compounds and elevated metals) were primarily in surface soils and sediments. Additional sampling was recommended to delineate the magnitude and extent of PAH contamination and metals in the surface water.

A Site 50 Addendum, Priority 1, Work Plan was submitted in October 1997 for follow-up sampling. Additional sediment and surface water samples were collected to investigate the nature and extent of metals and PAH compounds in the marsh area, located on the western edge of the site. Samples were collected and analyzed for VOCs, pesticides, PCBs, and explosive compounds to verify that these compounds were not released from the site.

The Draft Addendum Site 50 Report concluded that aircraft parts and building debris represent the materials which may have been present at the site. Chemical data from soil, surface water, sediment, and groundwater samples confirmed minimal environmental impacts from activities at Site 50. Two sampling episodes provide evidence that VOCs, pesticides, PCBs, and explosives contaminants are not a concern for the site. The data does indicate, however, that PAH compounds may have been released in the vicinity of buried aircraft parts.

The final SSP Addendum Site 50 Report, issued in August 2000, included a discussion of the 2000 surface water sampling program, a human health risk assessment, and an ecological risk assessment. The human health risk assessment indicated remedial action may be warranted for manganese in soils to comply with PRGs developed based on a residential scenario. A risk screening evaluation identified risks associated with groundwater at Site 50 were related to the widespread distribution of naturally occurring elements (primarily iron and manganese). An ecological risk assessment concluded there were potential concerns for copper in surface water, PAHs and vanadium in sediment, and zinc in surface soils. The ecological pathway of concern in each medium is direct contact with invertebrates and plants.

Potential risks to ecological receptors for vanadium in sediment were based on a single location being elevated above the Gambo Creek EC-Median. However, the mean sediment concentration for vanadium was below applicable guidelines, and Site 50 metal concentrations in soil were below background concentrations. Based on this information, no source for vanadium is anticipated at Site 50. The potential risk due to zinc in surface soils is primarily associated with a single “hot spot.”

Based on contaminant distributions and relatively low risk levels, a source removal alternative was recommended in the Site 50 draft EE/CA, which was made available for public comment and finalized in December 2000 (TtNUS, 2000b). The final EE/CA recommended excavation and offsite disposal of contaminated soil and debris for Site 50. The Removal Action for Site 50 was approved and initiated in May 2001. The Removal Action was completed in November 2001 (TtNUS, 2001e).

Following removal activities, the remaining soil, surface water, sediment, and groundwater were evaluated in a Site Decision Document. Based on the contents of the July 2003 Site Decision Document, it is the consensus of the Remedial Program Managers that this site requires no further action under a residential use scenario under CERCLA.

Wetland monitoring at Site 50, which includes two semi-annual inspections of each wetland mitigation project area, began in Fall 2003. At a meeting with EPA BTAG in February 2006, it was decided that starting in Spring 2006, the quantitative evaluation of vegetation can be replaced with a qualitative evaluation. The only significant finding in 2006 at Site 50 was the continued presence of phragmites, which was sprayed in October 2005 as part of a base-wide control program.

The 2007 wetland inspections were conducted on May 9, 2007 and November 7, 2007. The Draft 2007 Annual Wetland Monitoring Report was submitted January 2008. EPA BTAG comments regarding the report were received May 2008. Observations made throughout the five year monitoring period suggest the entire wetland mitigation are has been successfully converted into tidal wetlands. Herbicide was applied again in October 2007. If phragmites survives the treatment another application should be done annually until the phragmites is completely eradicated. The next round of wetland monitoring is scheduled for June 2008.

Based on comments received by EPA BTAG on the FY 2003 Wetlands Monitoring Report, benthic sampling should be conducted to ensure that native ecological systems are developing in the wetlands at Site 50. The first benthic macroinvertebrate sampling event took place in May 2005 and the BTAG concluded that additional sampling is necessary before any meaningful conclusions can be drawn. BTAG also suggested that a greater sample size (more than 2 samples per wetland) would be needed to generate sufficient data to quantitatively evaluate the development of an adequate benthic community.

Benthic macroinvertebrate sampling was performed in July 2007. Results suggest that the more saturated areas of the Site 50 wetlands have developed a benthic macroinvertebrate community partially similar to that of the adjoining intact wetlands. It was determined that the upper parts of the tidal marsh are more terrestrial in character and may not be appropriate for assessing as a wetland. During the December 2007 DIRT meeting it was recommended the sampling plan be refined to focus the sampling on the saturated areas. The next round of benthic monitoring is scheduled for June 2009.

SITE 51 - Battery Locker Acid Draining Area

The Battery Locker Acid Draining Area (known as USEPA SWMU 98) is inside Building 338, at Mainside. The site has been used since the mid-1980s for draining and refilling batteries. Typically, less than 150 gallons a year of battery acid are collected in the battery acid tank.

The Battery Locker Acid Draining Area consists of a wooden sink and a portable plastic tank, approximately 35-gallons in size, which replaced a limestone pit (the Battery Acid Draining Pit) in the mid-1980s which served the same purpose. There is no secondary containment for the tank, which is located on a concrete floor that has become pitted. The acid is hand piped from the draining table into the storage tank. Sulfuric acid that may have been released during the handling of batteries in years past would have gone to the drains in the building's floor. These drains have since been sealed.

Based on the findings in the SSP, Priority 1 Sites (B&R Environmental, 1996a) no further action was proposed.

SITE 53 - OWS 207-300

OWS 207-300 (known as USEPA SWMU 126) was near the gun cleaning area in the Main Range at Mainside, approximately 50 feet west of Building 207. The site was used from 1986 to Summer 1992 and was removed in May 1993. The OWS measured approximately two feet by four feet by two feet deep, had a capacity of 300 gallons, and was constructed of 1-inch-thick steel. It separated kerosene out of the water from the gun barrel degreasing trough, allowing the water to flow into the storm water drainage system.

A SSP investigation, Priority 1 Sites (B&R Environmental, 1996a) was performed on the site. The report recommended that additional sampling be performed in the drainage ditch to confirm previous soil removal activities were successful. If sampling results indicated little or no contamination, then no further action would be required.

In May 1997, an EE/CA was issued for this site documenting the need for confirmation sampling and possible further excavation, if warranted (U.S. Navy, 1997a).

Removal action was performed at the site between July and October 1997. In order to meet the ROAs, the contractor excavated approximately 11 CY of total petroleum hydrocarbon (TPH) contaminated soil from an area measuring approximately eight feet by eight feet, and extending to a depth of approximately seven feet. Excavated soil was directly loaded into waiting dump trucks. A final report was submitted in October 1998 (OHM Remediation Services Corp., 1998).

The remaining soil at Site 53 was evaluated in a Site Decision Document. Based on the contents of the September 2002 Site Decision Document, it was the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA (U.S. Navy, 2002g).

SITE 55 - Cooling Pond

The Cooling Pond (known as USEPA SWMU 129) is located in the southeastern part of Mainside, has a surface area of about nine acres, and began operations in the 1920s. There are two ponds (one small, one large) which are interconnected and discharge to Site 25 (Pesticide Rinse Area) by flowing over a weir. The ponds are connected to one another and discharge into Upper Machodoc Creek via the Virginia Pollution Discharge Elimination System (VPDES) permitted outfall.

Site 55 ranges in depth from zero to three feet. Bottom sediments are soft, dark gray, highly organic silts and clays. Stiff, plastic clay underlies the sediments, and this unit is documented to be relatively thick and laterally persistent throughout Mainside. Shallow groundwater from the industrial area located to the north likely discharges into the Cooling Pond. Vertical migration of surface water from the pond to lower geological units is unlikely due to the clay confining layer beneath the site.

Investigations of the Cooling Pond and monthly discharge monitoring by the personnel identified contamination in the fish and bottom sediment by oil and grease, PCBs, pesticides (primarily DDT and associated degradation products), and metals (arsenic, lead, cadmium, and mercury). Due to fish contamination concerns from ingestion, the Cooling Pond was posted as “Catch-And-Release.”

A sampling and analysis program was conducted in 1993 to investigate the presence and magnitude of previously identified contaminants (Geophex, 1993). The report from this investigation concluded the following:

- No PCB compounds were detected in the sediment samples.

- Mercury was detected in one of five sediment samples at 0.26 mg/kg and arsenic (2.6 to 10 mg/kg); chromium (12 to 36 mg/kg); and lead (5.9 to 190 mg/kg) were reported in all five samples. Other metals were not part of the analytical scheme.

- Seven of the twenty bottom sediment samples had reportable concentrations of 4,4’-DDT and its degradation products, 4,4’-DDD and 4,4’-DDE. Maximum concentrations were 1,200 μg/kg, 4,900 μg/kg, and 520 μg/kg, respectively. All of the fifteen fish tissue samples contained 4,4’-DDE; nine of which also contained 4,4’-DDD. In fish tissue samples #2 through #15, Aroclor-1260 was detected.

- Sampling personnel reported the presence of free product (visually identified as diesel fuel) in sediments along the north bank of the Cooling Pond.

- Geophysical surveys found twelve unidentified anomalies produced by ferromagnetic materials on the bottom of the Cooling Pond (Geophex, 1993).

Historically, up to 25 point source discharges were located around the pond. The discharges included storm water effluent, discharge from OWSs, and effluent from various buildings’ floor drains. In addition, petroleum constituents released from tanks located to the north of the pond likely migrated via groundwater and was discharged to the pond. Floor drains and OWSs no longer discharge to Site 55. Personnel indicated that all floor drains discharging to the Cooling Pond were sealed in 1994. Remedial actions have been performed to address petroleum-contaminated soils and groundwater affected by storage tanks in the vicinity of the pond.

A Remedial Investigation Work Plan was finalized December 1996. The work plan consisted of taking additional sediment and surface water samples to supplement the existing information and to fill data gaps to determine the nature and extent of contamination in the Cooling Pond. This data was used to support human health and ecological risk assessments for this site. A Draft Remedial Investigation Report was submitted in January 1999. The following recommendations were presented to address data gaps at Site 55:

- Conduct an FS to outline a collection and evaluation program for fish tissue to more accurately determine when fish ingestion restrictions could be eliminated.

- Continue with the "catch and release" posting at the site until future information or sampling dictates otherwise.

Site 55 was included in the FFS Priority 1 Sites Project Plans which were approved in 2000. These Project Plans detailed additional fieldwork to ensure that appropriate remedial alternatives were developed and evaluated. Fieldwork at Site 55 was conducted in July 2000. Fish sampling activities focused on small fish, large predator fish, and bottom dwelling fish. The resulting data were used to evaluate human health and ecological risk in the RI issued in July 2002 (TtNUS, 2002b).

The human health risk assessment concluded that no significant potential health hazards were associated with exposure to surface water, sediment, and fish at Site 55. The calculated hazard indices for the recreational user were greater than one. However, after additional analysis of individual target organs, no hazard index for any individual organ was greater than one. Therefore, risks were determined to be acceptable and no further action was warranted to address potential human health risks at Site 55.

The results of the ecological risk assessment indicated that no further action was warranted to address VOCs, SVOCs (except PAHs), pesticides, and PCBs detected at Site 55. Potential ecological risks were identified from PAHs, arsenic, cadmium, copper, and lead in sediment at Site 55. The RI made the following recommendations:

- Develop and implement a surface water and sediment sampling program designed to provide sufficient data to estimate risk from PAHs, arsenic, cadmium, copper, and lead in sediment in the eastern and northern part of the pond based on current conditions.

- Conduct a FS to identify, develop, and evaluate potential remedial actions should additional surface water and sediment sampling indicate that remedial action is warranted to address ecological risks.

Since samples at Site 55 were collected in 1994, 1997, and 2000, additional sediment samples were collected in July 2002 to provide more recent data on the Cooling Pond and to ensure knowledge of real-time conditions. Surface water samples were also collected to document current pond conditions. In addition, toxicity testing was performed on the shallow sediments to determine whether the potential risk to sediment-dwelling invertebrates identified in the RI ecological risk assessment actually exist. The 2002 sampling data were used to re-evaluate the ecological risks at the site and were presented in the final FS for Site 55, issued in May 2003. The FS concluded that no unacceptable risks were present at the site and recommended no action be taken at Site 55 (TtNUS, 2003d).

A PRAP was prepared for Site 55 recommending no further action be taken at this site (U.S. Navy, 2003a). The PRAP and public notice were issued to identify the public comment period starting May 19, 2003 and ending June 18, 2003. No comments were received during the 30-day public comment period or during the public meeting held on June 3, 2003. The Navy and USEPA signed a No Further Action ROD in August 2003, with VADEQ issuing a concurrence letter (US Navy 2003a).

2.3 PRIORITY 2 SITES

SITE 13 - Gambo Creek Truck Wash Area

Gambo Creek Truck Wash Area (known as USEPA SWMU 31), also known as the Inert Disposal Area, is located north of the CW Evaporation Pond (Site 14), south of Gambo Creek at Mainside. This site was used for vehicle washing by high-pressure water.

The Gambo Creek Truck Wash Area began operation in the 1980s and is no longer active. It is approximately one half-acre in size and semi-circular in shape. Its base is a mix of gravel and concrete, but the majority is soil with patches of vegetation. The northern edge of the site borders a marshy area of Gambo Creek. A five foot high earthen berm surrounds the site.

The Inert Disposal Area is adjacent to the Gambo Creek Truck Wash Area and is included as one site. A variety of construction debris was reportedly disposed at this site including rocks, broken-up cement and asphalt, construction debris, and dredged creek sediments.

A SSP was performed at this site and included two phases, a geophysical survey (Phase I) and a sampling program (Phase II). Information from the Phase I survey was used to aid in determining sample locations for the Phase II program. The geophysical survey conducted at this site revealed no significant anomalies associated with buried debris. Utility lines in the southeast corner of the site and a concrete pad with rebar were the only features of significance discovered. The sampling program consisted of surface and subsurface soils, surface water, sediment, and groundwater sampling. Groundwater sampling consisted of hydropunch sampling to investigate the potential for contaminant migration in the groundwater beneath the site (B&R Environmental, 1996c).

Based on the results of the Draft SSP Report (B&R Environmental, 1997), SVOCs, PCBs, and inorganic constituents were the primary concerns for Site 13. Conclusions from the contaminant assessment and screening evaluation recommended a removal action since the contaminant distribution was localized and confined to surficial media.

An EE/CA was performed and submitted in August 2001 to address Site 13 concerns and incorporated test pits to evaluate the extent and verify the type of debris and fill at the site. Three test pits were excavated at Site 13 in June 1998. Test pitting involved digging through the berm and the northern slope to define the depth and content of fill material. Based on the test pits, the berm consisted primarily of soil with minimal pieces of metal, concrete, and asphalt. The fill material in the berm extended approximately one foot below natural grade. The debris located on the slopes north, east, and west of the berm were primarily surface debris consisting of large blocks of asphalt and concrete. No additional fill soil was identified beyond the berm material.

The EE/CA incorporated human health and ecological risk assessments to evaluate potential risks at the site. The results of the human health risk assessment suggest that remedial action may not be necessary for the soils since contaminant concentrations do not pose a human health threat. Ecological risk screening concluded that inorganic concentrations (such as lead, mercury, and zinc) were a potential concern to ecological receptors. The Removal Action Design for Site 13 was approved and initiated in January 2002. The Removal Action was completed in June 2002. Significant quantities of concrete and asphalt were removed from beneath the former truck wash area. In addition, petroleum contamination was evaluated to determine the type of petroleum present and the extent of soil contamination.

Following the excavation and offsite disposal of contaminated soils, a Verification and Sampling Analysis (VSAP) Report was issued, providing results of the post-excavation confirmatory sampling activities at Site 13. Following the excavation the RPMs evaluated the results of the verification samples, soil stockpile samples, and petroleum characterization samples. The managers identified which soils were to be left in place, used as backfill at the site, or shipped offsite for disposal. The soil remaining at Site 13 was evaluated in a Site Decision Document. Based on the contents of the May 2003 Site Decision Document, it was the consensus of the Remedial Program Managers that Site 13 required no further action under a residential use scenario under CERCLA (U.S. Navy, 2003b).

Note: A typographical error in the FFA references the Old Compost Mound (Site 28) with the Gambo Creek Truck Wash Area (Site 13); however, the Old Compost Mound is Site 28. See Site 28 for a complete description.

SITE 20 - Former Electroplating Waste UST

The Former Electroplating Waste Underground Storage Tank (UST) (known as USEPA SWMU 83) is located on the western side of Building 404 at Mainside. This UST, originally a six feet by four feet by three feet concrete-block tank with a composite liner, was used from the early 1960s until some time before 1984, when it was decontaminated and filled with asphalt concrete. The closure certification for the in-place tank abandonment does not indicate that sampling was conducted. The tank originally held electroplating wastewater from Building 404.

A SSP was performed at this site and included both surface and subsurface soil and groundwater sampling. Soil samples were collected in order to determine the extent of vertical migration of contaminants. Groundwater samples consisted of hydropunch sampling in order to assess potential vertical migration of contaminants directly beneath the UST (B&R Environmental, 1997).

The primary exposure mechanism, as documented in the draft SSP Report, appeared to be potential vertical migration of metals from the vadose zone to the water table aquifer. Results from the groundwater investigation of Site 20 indicated that the concentrations of several metals exceeded screening criteria; however, given the existing exposure scenarios, potential risk is probably overstated. Therefore, the SSP concluded that the Building 404 operations in the plating room have not resulted in high concentrations to soils.

An addendum SSP investigation was recommended to address VOCs in groundwater by performing the following:

- Identify the horizontal extent of VOC migration, characterize the physical characteristics of the water table aquifer, and determine the groundwater flow direction. This data was to be used in locating monitoring wells for optional placement.

- The potential for vertical migration of VOCs was to be evaluated through the collection of physical and chemical data. Available geologic information indicated the presence of the Upper Confining Unit in the vicinity of Site 20. The thickness and physical characteristics of this unit were to be identified. Chemical data was to be obtained to determine if VOCs had migrated into the Upper Confined Aquifer.

The SSP, Priority 2 Sites, Phase II Project Plans Addendum was finalized in April 2001, and fieldwork began in May (TtNUS, 2001c). The scope of this effort was based on data gaps identified in the draft SSP Priority 2 Sites Report. This investigation was being carried out prior to approval of the SSP report in an effort to continue progress at the sites.

The investigation at Site 20 involved a detailed evaluation of chemical, geochemical, and hydrogeologic influences on the nature and distribution of contaminants in groundwater, as well as a screening level evaluation of natural attenuation potential and occurrence at the site. An integrated investigation strategy consisted of a real-time field screening investigation coupled with installation and sampling of permanent groundwater monitoring wells. Groundwater monitoring included collecting field and chemical data necessary to evaluate natural attenuation using the USEPA BIOCHLOR screening model.

The Draft RI was submitted in February 2002 (TtNUS, 2002a) and finalized in March 2005. The conclusions from the RI identified no significant potential health hazards associated with exposure to surface soil and ambient air at Site 20 under industrial, recreational, and residential settings. Potential adverse health effects might be associated with exposure to subsurface soil by excavation/construction workers and future residents and with the residential use of groundwater. However, there was considerable uncertainty in the calculated risks for these exposure pathways. The ecological risk conclusion stated that soil invertebrates and plants were at risk, but at low levels, with long-term exposure to metals, tetrachloroethene (PCE), PAHs, phenol, and PCBs in surface soils. Acute risk at some sampling locations was identified for phthalates, copper, and lead. Some vertebrates were at risk from PAH and metals-contaminated food. However, the site has low habitat quality, and future use is likely to be for a parking lot. Therefore, although concerns exist, risk is unlikely. The RI recommended no further action for site soils (TtNUS, 2005a).

Surface and stockpiled soils at Site 20 were removed in September 2003 and disposed offsite at a permitted facility as part of actions to restore the area following installation of new utilities. The soils contributing to potential ecological risk are no longer present. No further action with respect to site soils is proposed.

Initially, a draft FS was prepared in September 2002 to evaluate several alternatives. In lieu of finalizing the FS, a work plan for a pilot treatability study to perform in-situ chemical oxidation was prepared. After further evaluation of in-situ chemical oxidation, a lactate injection pilot test was proposed in 2003. However, the FS and the pilot treatability study have been deferred pending evaluation of the 2003 and 2004 groundwater sampling results.

Groundwater results were collected from Site 20 in November 2004 and the following maximum concentrations were detected: 46 µg/L PCE at GW 20-4, 43 µg/L TCE at MW 20-10, 13 µg/L 1,2-Dichloroethane (DCA) at GW 20-14, and 13 µg/L 1,1-DCE at GW 20-7. Natural attenuation appears to be occurring based on decreasing Contaminant of Potential Concern (COPC) concentrations and the presence of degradation products. In addition, groundwater is not being used at Site 20 nor is groundwater anticipated to be used in the future.

A Draft Technical Memorandum for Site 20 groundwater, which evaluated groundwater VOC concentrations from multiple rounds of sampling was issued by TtNUS in May 2005. The Technical Memorandum depicted some concentrations decreasing, while others were increasing. Because some of the groundwater MCLs are still being exceeded, primarily for 1,2-DCA, PCE, and TCE, and because the Human Health risk is above the target risk range for future residents under groundwater ingestion scenario for the above contaminants, some additional action is necessary. The DIRT agreed that a FFS should be completed for groundwater. All alternatives will include removal of the UST and surrounding soils, following by confirmation sampling. In addition, it was determined that soil vapor sampling should be performed near the surrounding buildings to detect any potential vapor intrusion. The draft FFS was completed for Sites 20 and 23 by TtNUS in March 2007 and identified the three groundwater remedial alternatives for Site 20 as shown below:

Alternative 1 – No Action
Alternative 2 – UST/Source Removal, Monitored Natural Attenuation, and Institutional Controls
Alternative 3 – UST/Source Removal, Enhanced Monitored Natural Attenuation (via Hydrogen Release Compounds), and Institutional Controls

A detailed analysis of the three alternatives was conducted, along with a comparative analysis of the alternatives. The FFS made no recommendations favoring one alternative over the other, but did analyze specific criteria for comparative purposes. The comparative analysis determined that alternative 3, while deemed to have the greatest short-term effectiveness and long-term protectiveness, as well as the greatest toxicity and volume reduction and compliance with applicable and relevant and appropriate requirements (ARARs), was also the most expensive of the three alternatives. In addition, it would require more extensive site activities, making it slightly more difficult to implement than Alternatives 1 and 2.

The results of the draft FFS were presented during the May 2007 DIRT meeting and it was decided to add a fourth alternative involving limited enhanced MNA in the known areas of groundwater contamination. Alternative 3 was broken into two separate but similar alternatives, 3b-UST/Source Removal, Targeted Enhanced Monitored Natural Attenuation, and Institutional Controls, was added to the FFS submitted in July 2007. This alternative is protective and compliance with ARARs would be completed within a shorter period of time than Alternative 2. Alternative 3b is less costly and easier to implement than Alternative 3a.

Soil gas screening was performed for Sites 20 and 23 in March 2007 to identify the potential for vapor intrusion into nearby buildings. With the exception of PCE, most “hits” were orders of magnitude below screening criteria. PCE was detected near the former UST location between the 10-6 and 10-5 screening criteria and is therefore within acceptable levels.

A PRAP was prepared for the following remedial alternative: removal of the UST concrete vault, removal of asphalt fill, concrete filled piping, and impacted subsurface soils in the area, sample remaining soil to confirm contamination removed, and fill with clean soil; enhanced bioremediation by injecting a hydrogen-releasing compound (HRC) into the contaminated groundwater to boost the natural attenuation; LTM of the sites to monitor expected reductions in contaminant concentrations, estimated to continue for approximately 25 years, and; land use controls (LUC) to restrict groundwater use at Sites 20 and 23 until levels of COCs are reduced to concentrations that allow for unlimited and unrestricted exposure. A public comment period started July 9, 2007 and ended August 9, 2007. Two comments regarding funding were received during the 30-day public comment period or during the public meeting held on July 16, 2007. The Navy and USEPA signed a ROD in December 2007, with VDEQ issuing a concurrence letter (U.S. Navy, 2007).

A VSAP was prepared by TtNUS to prescribe the verification sampling procedures for the removal action. The removal action consisted of three tasks:

- At Site 20, the concrete vault which housed the former Building 404 electroplating waste UST, its present contents (ground asphalt), and any associated piping will be excavated and removed for offsite disposal;

- At Site 20, contaminated soils surrounding the former Building 404 UST structures (i.e., tank vault and associated piping) will be removed to the extent practicable for offsite disposal, and

- At Site 23, the visibly contaminated surface soils (soils that contain metal filings) in the area of the former gun barrel cutting will be removed for offsite disposal.

Field Support Services, Inc. (FSSI) began the remediation activities in March 2008. Approximately 120 tons of soil were excavated from Site 20. Verification sampling indicated the need for additional excavation. An additional one foot of soil was removed from the base of the pit on March 28, 2008. Verification sampling of the base again indicated the need for additional excavation due to elevated concentrations of copper and chromium. An additional 18 inches was cut from the base of the excavation on May 7, 2008. Verification sampling of the base this time indicated that RAO's had been achieved. The DIRT discussed the verification sampling results during a May 19, 2008 telecom, and approved termination of digging, and the approval for backfill.

On Site 23 approximately 269 tons of soil was excavated per the approved Workplans, after which the site was backfilled with gravel. The drainage ditch between the gun barrel support and the rail bed was dug approximately 3 feet wide by 1 foot deep. Verification samples were collected and the results determined elevated arsenic concentrations. This issue was discussed at the March 2008 DIRT meeting and it was determined that the excavation should be backfilled with gravel until the appropriate coarse of action is determined to address the arsenic.

SITE 23 - Building 480 Lot (PCB Storage)

The Building 480 Storage Lot (known as USEPA SWMU 72) is located north of Building 480, along Tisdale Road in the southeastern portion of Mainside. The site is approximately a half acre in size and is surrounded by a 5-foot high chain-link fence. The area inside the fence is covered with either grass or gravel; the area surrounding the site is vegetated.

Since the 1960s, the Building 480 Lot has served as a scrap yard and storage area for large metal items, such as electric transformers, drums, and empty tanks. In the past, used transformers were stored in the northeast corner of the lot. Since November 1986 only new, non-PCB transformers have been stored there. At the time of the Navy Site Visit, the lot contained new non-PCB transformers, piping, bricks, electrical equipment, conduit, concrete blocks, empty new tanks, and empty 55-gallon drums.

A SSP Investigation was performed at this site in 1996 (B&R Environmental, 1997). A total of 23 environmental samples (14 surface soil, 4 subsurface soil, and 5 groundwater samples) were collected. Surface and subsurface soils were collected within the fenced area and along the primary and secondary drainage swales at the site. Hydropunch sampling was conducted to assess whether the groundwater was contaminated.

SVOCs, PCBs, and inorganic contaminants in surface soils were the primary concerns following a risk-based screening evaluation completed for the draft SSP Report. Vertical migration of contaminants to groundwater did not appear to be a significant transport pathway. VOCs detected in groundwater were suspected to be related to an upgradient source (Site 20).

Three actions were recommended for Site 23. First, a removal action was proposed to address localized SVOCs, PCBs, and inorganics in surface soil. Second, sampling and analysis was proposed to help define the extent of the affected areas. Since the primary inorganics of concern were arsenic and lead, appropriate cleanup criteria needed to be established for those compounds to protect both human and ecological receptors. Finally, site activities were to be reviewed to ensure the current operations were not adversely contributing to the environmental impact created from historical operations.

The SSP, Priority 2 Sites, Phase II Project Plans Addendum was finalized in April 2001, and fieldwork began in May (TtNUS, 2001c). The investigation was conducted before the SSP Report was approved, in an effort to continue making progress at the site. The following work was completed based on data gaps identified in the draft SSP Priority 2 Sites Report.

Two background surface soil samples were collected in areas close to the site that were not suspected to have been impacted by SVOCs, PCBs, and inorganic compounds from Site 23. Five surface soil samples were collected from the eastern drainage and southern portions of the site, in order to determine whether organic and inorganic compounds had migrated offsite via soil transport processes.

Groundwater sampling was conducted to evaluate VOC and inorganic compound concentrations detected during previous field investigations. Permanent groundwater monitoring wells were installed and sampled using low-flow sampling protocols to provide better representation of mobile metal concentrations for risk screening evaluations.

A revised SSP Report was completed in September 2003 in order to characterize the environmental condition of Site 23. In this report, new analytical data was combined with previous Site 23 data. The data, used for risk evaluations, supports the following recommendations:

- The historic cutting of gun barrels and the residual debris from this operation appears to be serving as a potential source of inorganic chemical contamination at Site 23. To reduce potential current and future ecological risk, a removal action should be considered for the metal debris observed in areas along the western side of Site 23.

- If future use of Site 23 remains industrial in nature (i.e., storage area, building installation), no further action is required to address potential ecological risks. However, if the site is returned to a native state that would provide acceptable habitat for ecological receptors, the site should be re-assessed for potential ecological risks from residual contamination.

- Any future evaluation of basewide storm water drainage impacts on Upper Machodoc Creek should include the potential contributions from Site 23.

The September 2003 Site 23 Sampling and Analysis Plan identified the process to obtain sufficient data to characterize surface soil and groundwater contaminant concentrations at the site. Groundwater results were collected from Site 23 in November 2004 and the following maximum concentrations were detected: 38 µg/L TCE and 10 µg/L 1,1 DCE at GW 23-12. Natural attenuation appears to be occurring based on decreasing COPC concentrations and the presence of degradation products. In addition, groundwater is not being used at Site 23 nor is groundwater anticipated to be used in the future.

In 2004 the DIRT determined that due to their proximity and similarity in contaminants, groundwater at Site 23 should be remediated along with Site 20; therefore all activities associated with Site 23 since 2004 are identical to Site 20. The reader is referred to the previous section on Site 20 for those details including discussion of the removal action conducted in 2008 at Site 23.

SITE 37 - Lead Contamination Area

The Lead Contamination Area (known as USEPA SWMU 108) is located at the southern tip of the installation at the confluence of Upper Machodoc Creek and the Potomac River. Large quantities of sand containing lead residues from projectiles (as well as the projectiles themselves) fired on nearby ranges were disposed of in this area for shoreline stabilization. Other heavy metals (e.g., iron, aluminum, copper, and nickel) are also present and may pose an environmental concern.

Information taken from historical aerial photography, the Remedial Action Plan developed for cleanup of existing indoor machine gun ranges, and interviews of personnel indicate that the machine gun range was constructed in the early 1940s and has been expanded in at least two phases. Projectiles fired on indoor ranges one through six impact sand "traps," which are located behind the targets to safely slow and stop the round. Range seven does not have a sand trap and is considered an open range.

The variety of ammunition fired at this site was reported to include 0.50- and 0.556-caliber, 7.62- and 40-millimeter ammunition, remnants of which were noted outside the range building in the disposal area. The ranges are designed so that projectiles expend their energy on the sand in the traps. However, the impact pulverizes the sand and a portion of the projectile into fine dust. Over time the accumulation of projectiles in the sand presents a ricochet hazard. Generally, the sand traps were said to be of comparable size (15 feet by 15 feet by 9 feet) and estimated to contain about 100 tons of sand, up to half of which was to be replaced when determined no longer useful. During times of heavy use, the bay might have been cleaned every month. The site has not been used heavily since the mid-1970s.

The shoreline in the vicinity of the machine gun range has also changed over time, as evidenced by aerial photography. Much of the filling conducted in this area appears to have taken place between 1937 and 1943 (based on aerial photos from those years); subsequent filling has been more gradual. Disposal of sand from the machine gun range has contributed to the evolving shoreline, but the extent is difficult to determine and is likely to be only a portion of what has occurred over 50 years. Several piles of material that appear to be sand were on the ground south of Building 200 in the April 1978 aerial photos. It is not evident whether this was sand from one of the bays or fill that had been dumped but not yet placed.

A SSP was performed at this site and included surface and subsurface soil, surface water, sediment, and groundwater sampling. Surface and subsurface soil samples were distributed throughout the site. These samples were used to determine potential areas of surficial and subsurface contamination at the site. Groundwater monitoring wells were installed and sampled to investigate potential groundwater contamination and migration. The wells were installed in the surficial aquifer and were placed in such a way that the screened interval straddles the water table UST (B&R Environmental, 1997).

Based on the results of the contamination assessment and risk screening evaluation, SVOCs and metals were identified as the primary concerns for Site 37. SVOC concentrations in surface soils at Site 37 are considered to be a potential risk to ecological receptors. Eleven PAHs were detected at concentrations exceeding ecological screening values. These exceedances were identified primarily in sample locations SS37-3 and SS37-9. Based on the occurrence and distribution of PAH compounds in soil, SVOCs in the subsurface are likely related to deposition of dredge spoils or redistribution from storm events. No SVOCs were detected in the groundwater samples collected onsite, and vertical migration of PAHs does not appear to be a significant transport mechanism.

Several inorganic compounds present at Site 37 were reported at concentrations elevated above applicable ecological screening criteria. Concentrations of copper, lead, and zinc in the surface soil appear to be significant risks to ecological receptors and their presence is likely attributable to the material used for filling at Site 37. In the sediment, concentrations of arsenic, cadmium, lead, and silver were identified to be minor potential risks to ecological receptors. Inorganic constituents present in sediments may be partially attributable to offsite sources due to tidal influence, but may also be the result of overland transport of affected surface soils.

Based on the conclusions of the screening evaluation, an RI was recommended at Site 37. The following areas were addressed during the RI (B&R Environmental, 1997):

- The conservative screening evaluation performed during the SSP indicates potential concerns, but generally the concentrations are not significantly elevated above screening values. A complete evaluation of risks to human health and ecological receptors should be performed.

- Delineate the extent of SVOCs (e.g., PAH) and metals which are identified at concentrations above those considered protective of ecological receptors, as determined by the risk assessment process.

The SSP, Priority 2 Sites, Phase II Project Plans Addendum was finalized in April 2001, and fieldwork began in May 2001 (TtNUS, 2001c). The scope of this effort was based on filling data gaps identified in the draft SSP Report, Priority 2 Sites. The 2001 field investigation for Site 37 included re-sampling of four onsite monitoring wells, installing and sampling two additional groundwater monitoring wells, and collecting surface soil samples. Data from the field investigations conducted in 1996 were combined with the data from the 2001 investigation and used to evaluate potential human health and ecological risks at the site.

The RI identified the following COPCs in the gun butt sand: antimony, chromium, copper, lead, manganese, mercury, nickel, silver, vanadium, and zinc. The human health risk assessment concluded that risk levels at the site are within acceptable levels based on current and future exposure scenarios. The ecological risk assessment concluded that there are potential risks to terrestrial and aquatic receptors from SVOCs, explosives, and metals concentrations found in soil and sediment. Therefore the RI recommended that a FS be developed to evaluate potential remedial alternatives for metals in surface soil near Building 200. The RI for Site 37 was finalized in March 2003.

In September 2003, Hurricane Isabel caused water levels in nearby Potomac River to reach 6 to 9 feet above normal levels. Combined high winds, storm surge and waves not only eroded away what little protection was available at the Building 200 shoreline, but uncovered previous lead contamination and eroded away existing vegetation.

The FS for Site 37 was completed and submitted in August 2004. The FS evaluated no action, construction of a cap over contaminated surface soil, and excavation of contaminated material and disposal in permitted landfills, and/or recycling. In Fall 2004, a ROD was prepared for Site 37, which included excavation and off-site disposal of gun butt sands and contaminated soil in a permitted landfill. The remedial design was completed in April 2005.

During Summer 2005, it was decided that the remedy selected in the ROD would be modified due to concerns related to the potential for uncovering unexploded ordnance during excavation at Site 37 and the site's proximity to a number of operating facilities that could be impacted by shutdowns during Unexploded Ordnance (UXO) screening activities. It was decided that the ROD would be amended and that the remedy would include a two foot soil cover over the gun butt sands and contaminated soils and erosion protection along the shoreline. The cover remedy will greatly lessen any potential exposure to unexploded ordnance during construction.

As part of the revised design, additional pre-design investigations were completed in 2005 including a bathymetric survey in upper Machodoc Creek adjacent to the site, sediment sampling in the same area for geotechnical characteristics of the sediments, and a gun butt sand delineation investigation.

The gun butt sand investigation was completed to more accurately delineate the northwestern extent of gun butt sand and associated contaminated soil at Site 37. The investigation, performed in November 2005, included the visual inspection of hand augered soils, visual inspection of surface soils, and analysis of surface soil samples collected from each of the 32 boring locations. Each boring was advanced to an average depth of two feet. The samples collected from the borings were analyzed for Target Analyte List (TAL) metals. Gun butt sands were visually identified at three locations in the investigation area and concentrations in excess of the remediation goals for Site 37 were detected in six borings. The area of gun butt sands and contaminated soil was increased by approximately 16,750 square feet from the area shown in the original design documents.

The amended remedial action would addresses protection of ecological receptors (plants and animals) from surface soil contaminated with copper, lead, silver, and zinc. The major components of the selected remedy are a soil cover, shoreline rip-rap stabilization, geotextile marine mattresses, institutional controls

(IC) to ensure that the soil cover is not disturbed; and LTM to ensure that contaminants are not released from the site.

The Navy issued a Proposed Plan and presented it in a public meeting in December 2005. A Record of Decision Amendment was signed with EPA Region III and the U.S Navy in August 2006. VDEQ concurred with the ROD amendment. The remedy consists of a soil cover, rip-rap shoreline stabilization and geotextile marine mattresses. The marine mattresses were installed at the toe of the shoreline, and were an integral part of the remedy to eliminate the need to excavate for rip-rap installation. Due to potential UXO concerns along the shoreline, the remedy was restricted to very limited excavation including small drainage channels, minor grading, and surficial UXO clearance for construction laydown areas. The remedy also requires engineering and access controls (institutional controls), to ensure that the soil cover is not disturbed in the future. Future activities will be restricted to prevent intrusion into the capped area. The remedy was also designed to reduce onsite construction schedules and minimize disruptions to workers inside Building 200.

The design and construction work plans were submitted and construction began in Fall 2006. Construction was successfully completed in October 2007. Vegetation will be planted on the upper terrace of the triton mattresses after the areas are silted in due to natural tidal processes. The natural coastal silt deposits will be a more effective base for planting. Planting is currently scheduled for Summer 2008. Maintenance activities for Site 37 will be conducted annually and will be described in the Dahlgren Landfill Operations and Maintenance Manual for Sites 2, 9, 17 and 37 (TtNUS, 2007e). In addition, the Navy is currently investigating for the presence of depleted uranium (DU) around Building 200, which is part of the Site 37 construction site. Remedial action is scheduled to take place in FY 2009. A DU gun butt area (Site 49), which was remediated in 1998, was formerly located outside Building 200.

SITE 56 - Gun Barrel Degreasing Area, Railway Spur

The Gun Barrel Degreasing Area, Railway Spur is located along an inactive railroad track between Route 301 and Magazine #4, close to Gate B on Mainside. It was used from 1961 to 1975 to store and degrease 3-inch and 5-inch diameter 54-caliber gun barrels. As many as 6,000 gun barrels were stacked along approximately one mile of railroad track at any time. Currently, the rail line is overgrown with trees and brush and the railroad tracks have been removed. In the past, small quantities of a brittle, “tarry” substance were noted on the railroad tracks along much of the site and appeared to be related to the degreasing operation.

Degreasing the inside of the gun barrels was undertaken through steam injection followed by sponging to remove cosmoline, a grease preservative containing mineral spirits that is used to prevent rust. Following sponging, a small amount of trichloroethene (TCE) or other solvent was used to remove any residual preservative. After cleaning, the gun barrel was gauged for wear. Barrels that were not of proper specifications were sent out as scrap metal, and good barrels were recoated with cosmoline and placed back in service.

A SSP Investigation was performed at this site in 1996. A total of 35 environmental samples were collected, including six surface soil, six subsurface soil, eight sediment, eight surface water, and six groundwater samples. In addition, a “tarry” substance believed to be cosmoline was collected adjacent to the railroad tracks.

Based on the results of the contamination assessment and risk screening evaluation in the draft SSP Report (B&R Environmental, 1997), SVOCs (particularly PAHs) in surface soils were a primary concern. PAH concentrations in surface soils were identified as a potential risk to ecological receptors. However, the PAH concentrations which exceeded the ecological screening criteria were limited to samples collected in the northern portion of the site and did not appear to be related to degreasing activities.

The SSP Report also identified metal contaminants as a concern in both surface and subsurface soils. Several inorganic constituents present at Site 56 were detected at concentrations exceeding applicable human health and ecological risk-based screening values. Arsenic concentrations in the surface and subsurface soil were considered a risk to human receptors. Concentrations of antimony, chromium, lead, and zinc in the surface soil appeared to present significant risks to ecological receptors.

Based on the conclusions of the risk screening evaluation, further characterization of the extent and magnitude of PAHs and metals (arsenic, cadmium, lead, and zinc) was recommended. In addition, appropriate cleanup criteria were needed to protect human and ecological receptors.

A SSP, Priority 2 Sites, Phase II Project Plans Addendum was finalized in April 2001 and fieldwork began in May 2001 (TtNUS, 2001c). The investigation was conducted before the SSP Report was approved in an effort to continue making progress at the site. The work was performed to fill data gaps identified in the draft SSP Priority 2 Sites Report.

Surface soil samples were collected at other railroad track locations on the base to assist in establishing “background” organic and inorganic compound concentrations associated solely with railroad operations. Three monitoring wells were installed at the site using hollow-stem auger drilling methods. These wells and two existing U.S. Geological Survey (USGS) wells were sampled for VOCs, SVOCs, and total metals plus cyanide.

A revised SSP Report was completed in September 2003 to determine if the site warranted additional investigation, removal action, or no further action. In this report, the 2001 “background” railroad data was compared to the 1996 surface soil results to evaluate site-specific risk. In addition, groundwater data collected in 2001 was used to evaluate potential risk from groundwater ingestion and surface water discharge. Minimal amounts of the contamination found at the site can be directly attributed to past gun barrel degreasing operations. Based on the contents of the SSP report, it is the consensus of the DIRT Program Managers that this site requires no further action under a residential use scenario under CERCLA. The contamination and associated risk appears to be consistent with that found at other railroad rights of way and does not appear to be associated with historical gun barrel degreasing operations.

SITE 57 - Shell House Dump

The Shell House Dump (known as USEPA SWMU 133) is located on Mainside, north of Building 985 and bordering the northern edge of Buck Lane Road. This site is about one acre in size and was used from the 1960s to the late 1970s as a repository for metal objects and debris. The following items have been found at the site: four HedgeHog bombs (3 - inert, 1 - live), old fiberglass rocket motor cases, aircraft parts, wooden pallets, ammunition crates, and one 55-gallon drum of roofing tar. The live HedgeHog bomb and 55-gallon drum were removed and disposed of properly.

A SSP field investigation was performed at this site in 1996. Phase I of the SSP consisted of a geophysical investigation, including both magnetic and electromagnetic surveys. There was no indication of waste burial or areas of disturbed soils in the geophysical results. Phase II of the project consisted of site sampling. A total of 32 environmental samples were collected including ten surface soil, eleven subsurface soil, four surface water, four sediment, and three groundwater samples. Three groundwater monitoring wells were installed in the surficial aquifer for sampling purposes.

Based on the results of the contamination assessment and risk screening evaluation in the draft SSP Report (B&R Environmental, 1997), SVOCs (specifically PAHs) and metals in surface soils were the primary concerns for Site 57. PAH concentrations that exceeded ecological screening values occurred only in surface soil sample SS57-7. Since PAHs were not detected in subsurface soils, the contamination had not migrated vertically and appears to be localized in the shallow soils.

Concentrations of cadmium (in surface soil) and mercury (in surface and subsurface soil) were considered a potential risk to human receptors. However, the risk was based on a conservative residential scenario for soil to groundwater transfer criteria. Since shallow groundwater is not a drinking water source in the vicinity of Site 57, risk to human health might have been overstated. Concentrations of cadmium, copper, lead, mercury, and zinc in the surface soil were considered potential risks to ecological receptors. Elevated levels of cadmium and copper were limited to sample locations SS57-5 and SS57-7. Cadmium, copper, and lead were not detected in the filtered groundwater samples, indicating that significant vertical migration and groundwater transport has not occurred. The source of the inorganic constituents may be related to past disposal activities.

The draft SSP Report recommended a removal action to address the localized contamination in the surface soils. Specifically, the surface soil piles in the vicinity of sample locations SS57-5 and SS57-7 were to be excavated; visible surface debris was to be cleaned up; and contaminated soils were to be disposed offsite. Cleanup goals based on risk to human health and ecological receptors were to be established.

A SSP, Priority 2 Sites, Phase II Project Plans Addendum was finalized in April 2001 and fieldwork began in May 2001 (TtNUS, 2001c). The investigation was conducted before the SSP Report was approved in an effort to continue making progress at the site. The work was performed to fill data gaps identified in the draft SSP Priority 2 Sites Report.

Surface and subsurface soils were re-sampled in two locations to assess the presence of mercury, which had been detected during the 1996 SSP. Verification of the mercury concentrations was necessary to identify potential ecological risks. In addition, monitoring well GW57-2 was re-sampled for inorganic constituents to confirm the lead concentration detected in the well during the 1996 SSP.

A revised SSP Report was completed in December 2003 in order to determine if the site warranted additional investigation, a removal action, or no further action. In this report, data from the soil and groundwater samples collected during the 1996 and 2001 field investigations were used to evaluate site-specific risk. The report found that because potential contaminants from site activities are unknown, the spatial distribution of chemicals in various media assists in determining which contaminants may or may not site-related. Contaminants found in the subsurface soils are either naturally-occurring, anthropogenic, or are related to site activities. However, the contamination found in sediments and surface water in the intermittent drainage ditch appears to be primarily derived from a source upstream of Site 57. Of the media investigated, only the surface soils contain elevated site-related constituents, such as PAHs, pesticides, and metals. From a human health perspective, no significant risk was identified in site media.

The ecological risk assessment and risk management found potential risk from PAHs, pesticides and several metals in surface soils. PAHs and pesticide concentrations in surface soil were not exceedingly high and do not appear to require remedial action. Metals concentrations in surface soil appear to be localized at sample location SS57-5. The SSP recommended that, in consideration of the level of potential ecological risk estimated at Site 57, a hotspot removal should occur near sample SS57-5.

In the February 2008 DIRT meeting a decision was made that additional sampling should occur to determine the contaminant distribution along the ditch leading to Gambo Creek. The hotspot area should also be sampled at that time. The results will be summarized in a Technical Memorandum. A draft SSP UFP-SAP addressing the proposed sampling is scheduled to be submitted in October 2008 and the draft SSP Technical Memorandum is scheduled to be submitted in March 2009.

2.4 PRIORITY 3 SITES

SITE 4 - Case Storage Area

The Case Storage Area is located on the western bank of Gambo Creek at the end of an access road off Bennion Road, in the northwestern quadrant of Mainside. The area is approximately 1.1 acres in size and surrounded on all sides by woodland.

The Case Storage Area began operations in the 1940s as the Defense Reutilization and Marketing Office (DRMO) lot. The lot was used primarily for storing ordnance materials for inert certification, disposal, and reutilization until Fall 2002. The ordnance items stored here include empty projectile cases, ammunition containers, powder cases, rocket motor cases, etc. Other items stored at Site 4 included radar vans and systems, antennas, machine shop equipment, and surplus metal working equipment. On occasion, abandoned automobiles have been stored at the site prior to sale as scrap materials.

A field investigation to support a SSP was conducted at Site 4 between November 2001 and March 2002 and included the following activities (CH_2M Hill, 2001b):

- Geophysical survey
- Confirmatory trenching
- Surface and subsurface soil sampling
- Monitoring well installation and groundwater sampling
- Surface water and sediment sampling

The geophysical survey was conducted at Site 4 using an electro-magnetic (EM) survey to help determine the location of buried waste and the boundaries of the site. The results of the survey were used to select locations for confirmation trenching to identify waste contents, depth of buried materials, and lateral extent of the waste. Eighteen trenches were dug over three days around Site 4 and subsurface soil samples were collected from four of the trenches. In addition to those samples, six surface and eight subsurface soil samples were collected from other locations at Site 4. Three monitoring wells were installed and sampled to characterize groundwater. Finally, one surface water and three sediment samples were collected and analyzed. Perchlorate analysis was performed on the groundwater samples collected at Site 4 in 2002. Using a detection limit of 5 µg/L, perchlorate was detected in three of five samples at a concentration of 5 µg/L in each sample.

A draft SSP report was issued in April 2003 and was finalized in September 2004 (CH_2M Hill, 2005b). This report presents the results of the geophysical testing, trenching, and soil, groundwater, surface water and sediment sampling activities, and a quantitative risk assessment for Site 4 and recommends a removal action based on the findings.

A Final EE/CA (JMWA, 2004c) was been submitted for Sites 4 and 15 in September 2004. The EE/CA developed and screened remedial action alternatives, which met the site-specific remedial action objectives and satisfied ARARs. The EE/CA recommended excavation of contaminated soil and debris, soil screening, reuse of soil as backfill, and off-site disposal of the contaminated materials and site restoration.

Due to their proximity to each other and similarity of contaminants, Sites 4 and 15 are being remediated concurrently. Remediation at Site 4 began with mobilization in March 2005 and excavation activities using a tracked excavator with a blast shield began in April 2005. Based on the SSP and EE/CA, it was estimated that 2,500 CY of soil will need to be removed. Due to the presence of more than anticipated ordnance related scrap (ORS), additional areas are being excavated, and to date 5,160 CY have been excavated. Twelve of the eighteen proposed sampling areas have been excavated and sampled and confirmation samples from eleven areas have passed the screening criteria; one area failed based on elevated SVOC concentrations and will be resampled. As of May 12, 2006, approximately 9,491 of material have been excavated with the following breakdown:

- 9,460 tons soil
- 23 tons scrap metal
- 5 tons ORS
- 2 tons target material
- 1 ton construction debris

Physical soil screening began in June 2005 using an 883 Finley with a two inch vibratory screen on top and a one inch screen on the bottom with magnetic separation and proceeded at an average rate of 123 CY/day. Metals were separated into ORS and non-ORS (scrap metal) piles and soil was placed in 500

CY stockpiles for analytical sampling. The ORS was segregated into size and nomenclature for disposal by the Navy facility at Pumpkin Neck. A total of ten stockpiles have been sampled and returned to the Site 4 excavation. Soil screening continued at Site 4 until December 2005, when colder temperatures prevented the soils from drying out and made screening difficult. At that time, soil excavation and screening operations were moved to Site 15 where the soil material was more granular and drier. A large stockpile (approximately 2,000 CY), which still needs to be screened remains on Site 4 and the material beneath the large stockpile still needs to be excavated and screened. Toltest demobilized from Site 4 in June 2006 due to a lack of funding due to greater than expected soil volumes.

In 2006, the Navy determined a need to prepare a draft Explosives Safety Submission (ESS). The ESS was initially prepared in Fall 2006 but had to be revised due to changes in the Explosives Standard Operating Procedures. CH_2M Hill prepared a revised ESS, which was submitted to NOSSA in June 2007 and comments were provided. The ESS submission was then transferred to NSWC G65, and currently under review by NOSSA. A temporary shield is under review with NOSSA. The shield is built on a skid and designed to be moved by the excavator as work progresses. The VSAP for Sites 4 and 15 was finalized and submitted in June 2008. The ESS and SAR are in the final stages awaiting approval from NOSSA. Field work is scheduled to resume as early as August 2008 pending final approval.

SITE 14 - CW Evaporation Pond

The CW Evaporation Pond (known as USEPA SWMU 28) was originally operated south of Building 1356 at Mainside. The site was approximately 120 feet by 60 feet in size with a depth of approximately 2 feet.

This site was built in 1967 for the disposal of solutions of decontaminated CW waste. In the early 1970s, the liner was replaced due to failure of its exposed portion. On a few occasions, the site had been used for other purposes. Treated solutions from electroplating operations, such as the circuit board printing shop, were disposed of on an emergency basis, by being placed in the evaporation pond. The site has not been used since the late 1970s.

In April 1982, samples of water, sludge, and surrounding soil at the CW Evaporation Pond were collected and analyzed to see if they exhibited any characteristics of hazardous waste. Results indicated that the water, sludge, and surrounding soil are not hazardous.

In the mid-1980s the CW Evaporation Pond was closed and all sludge and soils suspected of being contaminated were disposed of as a listed waste offsite at a RCRA Subtitle C landfill. Additionally, three groundwater monitoring wells were installed and the area was regraded. In 1993, three wells were sampled, and no hazardous constituents were detected. Sulfur and iron were the only constituents detected.

A field investigation to support an SSP was conducted at Site 14 between December 2001 and March 2002. Field activities included the following (CH_2M Hill, 2001b):

- Monitoring well installation and groundwater sampling
- Surface and subsurface soil sampling
- Sediment and surface water sampling

Three monitoring wells were installed and sampled to characterize groundwater. In addition, seven surface soil, three subsurface soil, one surface water, and four sediment samples were collected and analyzed at Site 14. The draft final SSP report, issued in April 2003, was reviewed by USEPA and VDEQ and was finalized in September 2004. This report presents the results of the sampling activities at Site 14 and makes the following recommendations based on the findings.

- Collect additional subsurface soil samples from within the former pond area and analyze for TAL metals, including hexavalent chromium, to delineate the extent of elevated COPC in the subsurface soil.

- Install up to one additional upgradient monitoring well and two downgradient wells, and perform an additional groundwater sampling round for the COPC carried through the human health risk screening in groundwater.

- Conduct hot spot removal action of surface and subsurface soils containing elevated levels of COPC (specifically chromium) and collect verification samples.

- Based on the new sampling information, reevaluate the human and ecological health risks for COPC in surface soil, subsurface soil and groundwater.

A pre-EE/CA soil investigation was conducted by CH_2M Hill from January to March 2005 to characterize chromium (total and hexavalent) concentrations in subsurface soil to identify the extent of the proposed removal action. Soil samples were collected from three depth intervals (2 to 3 feet, 5 to 6 feet, and 9 to10 feet bgs at three locations (14SB-11, 14SB-16 and 14SB-17), which corresponded to areas where previous sampling revealed elevated concentrations of total chromium. In the 2 to 3 foot interval, total chromium concentrations ranged from 12 mg/kg to 1,120 mg/kg and hexavalent chromium concentrations ranged from 3.2 mg/kg to 35 mg/kg. Chromium concentrations were greater than background (18.5 mg/kg) across the entire extent of the former CW pond. Total chromium was detected at concentrations of 5.5 mg/kg to 574 mg/kg in the 5 to 6 foot depth interval. Concentrations of total chromium (1.5 to 26.2 mg/kg) were significantly lower in subsurface soil samples collected from 9 to 10 feet bgs. The highest concentrations of chromium in subsurface soil were detected in samples collected in the south and west areas of Site 14.

CH_2M Hill began preparing an EE/CA in Fall 2005 to evaluate surface and subsurface soil removal options for chromium contamination and the final EE/CA was submitted in April 2006. The following remedial action objectives were developed:

- Remove and properly dispose of contaminated subsurface soil
- Provide additional soil amendment to enhance groundwater remediation at the site
- Perform confirmatory sampling to confirm that the soil left in place does not represent an unacceptable risk to human health and the environment, and does not provide a continuing source of contamination to soil or groundwater

As part of the EE/CA, cleanup goals were established to determine the areas within a site that require a removal action. Cleanup goals were based on RBCs of 230 mg/kg of hexavalent chromium and a Soil Screening Level of 42 mg/kg. Additional total chromium concentrations were screened against the background chromium concentration of 18.5 mg/kg. Based on an evaluation of several alternatives by comparing their effectiveness, implementability, and cost, this alternative was chosen because it would meet the RAOs with the greatest probability of success. The recommended alternative consisted of:

- Excavate subsurface soil from 2 to7 feet bgs (based on a cleanup level of 42 mg/kg hexavalent chromium) and stockpile clean soil
- Apply a calcium polysulfide compound at approximately 10 feet bgs
- Transport any contaminated soil off-site and dispose in an appropriate waste facility.
- The excavation would then be backfilled with clean fill, regraded and revegetated.

A “Final Action Memorandum Site 14 – Former Chemical Waste Evaporation Pond” (CH_2M HILL, 2006) was submitted and signed in September 2006. The purpose of this memorandum was to document approval of the recommended non-time critical removal action at Site 14.

In November 2007 the "Preconstruction Work Plan Addendum for Phase I Sampling and Fluid Evacuation Activities" (CH_2M HILL, 2007) was submitted for review. A Removal Action began in January 2008 at Site 14. Removal activities began with pipeline sampling and evacuation of the piping. There was no evidence of CWA in pipe samples. Overburden soils were excavated and staged on-site for re-use. DIRT approved the use of the overburden materials as fill in the February 2008 meeting. Following removal of the estimate volume of soil above action levels, confirmation samples indicated chromium was still present above the action levels at the base of the excavation and along the south side wall. An additional one foot of soil was excavated from these areas. Confirmation samples again indicated levels above the action limit in the western portion of the excavation base. Samples following the third removal indicated that action levels were achieved. Excavation of "clean" subsurface soils was then conducted to approximately eleven feet below grade exposing the groundwater table. Approximately 2,750 tons of impacted soils were excavated and transported to an off-site disposal facility. Following exposure of groundwater in the base of the excavation; approximately 3,100 gallons of calcium polysulfide was pumped into the excavation footprint and allowed to combine with the groundwater. The calcium polysulfide is intended to facilitate the conversion of hexavalent chromium to trivalent chromium. The excavation was then backfilled with stone, clean fill and previously staged overburden. The contaminated soil was sent for offsite treatment, and offsite delisting to then be transported to a RCRA Subtitle D landfill. The next course of action for Site 14 is addressing the underground piping. Piping associated with Site 14 will be cut into smaller pieces, placed into drums, hot-boxed and disposed of in an off-site RCRA Title D landfill. This action is anticipated to occur in the Fall/Winter 2008.

SITE 15 - Scrap Area

The Scrap Area is located on the same access road as Site 4, near the intersection with Bennion Road in the northwestern quadrant at Mainside. The area of the site is approximately 0.73 acres in size and surrounded on all sides by woodland and drains to Gambo Creek approximately 300 feet to the east.

Similar to Site 4, the Scrap Area began operations in the 1940s as a DRMO lot. The lot was used primarily for storing ordnance materials for inert certification, disposal, and reutilization until Fall 2002. The items stored here include sheet metal, old machinery, tires, electrical equipment, and railroad ties. A field investigation to support an SSP was conducted at Site 15 between December 2001 and March 2002. Field activities included the following actions (CH_2M Hill, 2001b):

- Geophysical survey
- Confirmatory trenching
- Surface soil and subsurface soil sampling
- Surface water and sediment sampling

- Monitoring well installation and sampling

The geophysical survey conducted at Site 15 employed an EM Survey to help determine the location of buried waste and the boundaries of the site. The results of the survey were used to select locations for confirmatory trenching to identify waste contents, depth of buried materials, and lateral extent of the waste. Nine trenches around Site 15 were dug over a three day period. Subsurface soil samples were collected from four of the trenches. In addition to those samples, five surface and eight subsurface soil samples were collected from other locations at Site 15. Four monitoring wells were installed and sampled to characterize groundwater. Two surface water and six sediment samples were also collected. Perchlorate analysis was performed on the groundwater samples collected at Site 15 in 2002. Using a detection limit of 5 µg/L, perchlorate was detected in one of five samples at a concentration of 5 µg/L.

A draft SSP report was issued in July 2003, was reviewed by USEPA and VDEQ and was finalized in September 2004 (CH_2M Hill, 2005b). This report presented the results of the geophysics, trenching, soil, groundwater, surface water, and sediment sampling activities along with a quantitative risk assessment at Site 15 and made recommendations based on the findings.

A Final EE/CA (JMWA, 2004c) was submitted for Sites 4 and 15 in September 2004. The EE/CA developed and screened alternatives that met the site-specific remedial action objectives and satisfied the ARARs. The EE/CA recommended excavation of contaminated soil and debris, soil screening, reuse of soil as backfill, and off-site disposal of contaminated materials.

Due to their proximity to each other and similarity of contaminants, Sites 4 and 15 are being remediated concurrently. Excavation at Site 15 began in May 2005. Three of the fourteen proposed excavation areas have been excavated and sampled and confirmation samples from all three areas passed the screening criteria. As of May 12, 2006, approximately 5,795 tons of soil and debris have been excavated with the following breakdown:

- 5,671 tons soil
- 89.5 tons scrap metal
- 0.9 ton ORS
- 0.4 tons target material
- 33 tons construction debris

Soil screening began in January 2006 using an 883 Finley with a two inch vibratory screen on the top and a one inch screen on the bottom with magnetic separation at an average rate of approximately 70 CY/day. Metals are separated into ORS and non-ORS (scrape metal) piles and soil is placed in 500 CY piles for analytical sampling. Two stockpile samples have been analyzed to date and 1 has failed based on elevated PCB concentrations and consequently 750 CY of soil has been designated for off-site disposal. The debris was disposed of off-site by Burgess Hauling.

Due to limited space available at Site 15 and the accumulation of greater than expected quantities of scrap material, it was necessary to generate additional storage and working space at the Site. This was accomplished in May 2006 by removing an area of trees approximately 200 feet by 75 feet northwest of the proposed site excavation. Currently, this cleared area will be used to store soil stockpiles which have been screened. Toltest demobilized from Site 15 in June 2006 due to a lack of funding due to greater than anticipated soil volumes.

In 2006, the Navy identified a need to develop an ESS for Site 15 prior to resuming excavation. A draft ESS was initially prepared in Fall 2006 but had to be revised due to changes in the Explosives Standard Operating Procedures. CH_2M Hill prepared a revised ESS, which was submitted to NOSSA in June 2007. The VSAP for Sites 4 and 15 was finalized and submitted in June 2008. The ESS and SAR are in the final stages awaiting approval from NOSSA. Field work is scheduled to resume as early as August 2008 pending final approval.

SITE 38 - Building 1349 Pest Control Outside Area

The Building 1349 Pest Control Outside Area (known as USEPA AOC I) is on the eastern side of the Pest Control Building at Mainside. The area consists of a gravel-covered parking lot approximately 50 square feet and a concrete pad measuring approximately 15 feet by 20 feet. The gravel lot is bermed with soil on two sides. The concrete pad is sloped and has an approximately 4-inch high concrete berm on the sides and the lower end. The berm at the lower end has an opening approximately one foot in length that would allow liquids on the pad to flow onto the lot. Liquids that enter the drain at the lower half of the pad would flow to a lift station and then to the storm sewer.

The gravel area is used to stage trailers that carry pest control equipment, including bulk pesticides and spray hoses, and as an area to mix pesticides. Rinsate from bulk pesticide containers is used to fill pesticide sprayers. The concrete pad is not used. At the time of the Navy Site Visit, the drain in the concrete pad appeared to be clogged, as standing water was visible around the drain. Modifications made in 1994 included plugging the drain, extending the concrete pad, and adding a canopy over the pad.

A field investigation to support an SSP was conducted at Site 38 between December 2001 and March 2002. Field activities included the following (CH_2M Hill, 2001b):

- Surface and subsurface soil sampling
- Monitoring well installation and groundwater sampling
- Surface water and sediment sampling

Three monitoring wells were installed and sampled to characterize groundwater. In addition, six surface soil and three subsurface soil samples were collected at Site 38. A draft final SSP Report was reviewed by USEPA and VDEQ and was finalized in September 2004 (CH_2M Hill, 2005b). This report presents the analytical results from the sampling activities and makes recommendations based on those findings. Based on results of the final SSP Report, No Further Action under a CERCLA residential use scenario was recommended and accepted by the DIRT on May 2005 and Site 38 was closed out.

SITE 40 - Building 120B DRMO Lot

The Building 120B DRMO Lot (known as USEPA SWMU 14) is located east of Building 120B at Mainside. It is surrounded by an approximately 7 foot high chain-link fence and is approximately one acre in size. There are no curbs or dikes around the lot. Building 120B DRMO Lot has been in use since about 1945.

This asphalt lot is used to store product supplies for the, such as metal equipment and drums of hydraulic oil, motor oil, potassium hydroxide, and cleaning/degreasing solvents. Waste lead-acid batteries and scrap metal are also stored there. At the time of the Navy site visit, none of the products or wastes were stored with secondary containment.

The reported sources of potential contaminants at Site 40 include hydraulic oil, motor oil, potassium hydroxide, cleaning/degreasing solvents, and waste lead-acid batteries stored in the DRMO Lot. A field investigation to support an SSP was performed at Site 40 between September 2001 and October 2001 and included the following activities (CH_2M Hill, 2001a):

- Surface and subsurface soil sampling
- Monitoring well installation and groundwater sampling

Three monitoring wells were installed and sampled to characterize groundwater. Twelve surface soil and six subsurface soil samples also were collected and analyzed. The results of the SSP field investigation indicated the presence of inorganics, VOCs, SVOCs, pesticides, and PCBs in the surface soil, subsurface soil, and the groundwater at Site 40. Five constituents were identified as COPCs in the surface and subsurface soil as part of the human health residential risk screening characterization, and five COPCs were identified in the groundwater. However, using industrial screening criteria, which are more appropriate for the existing use of the DRMO Lot, there are no COPCs in the surface and subsurface soil. Two VOCs and three pesticides were retained as COPCs in groundwater; however, the VOCs and beta-BHC were not detected above their respective MCLs. In addition, the presence of the other pesticides is attributed to facility-wide pesticide use rather than activities at Site 40. The report recommended that No Further Action be taken with regard to groundwater at Site 40.

The ecological risk assessment indicated a potential risk to terrestrial plants and/or soil invertebrates from PAHs (primarily) and from a limited number of inorganic chemicals in the Site 40 surface soil. However, based on the low level of ecological risk indicated by Step 3A risk calculations and the low quality habitat provided by this site, no further evaluation of ecological risk was recommended for Site 40. Perchlorate analysis was performed on the groundwater samples collected at Site 40 in 2002. Non-detected results, using a detection limit of 4 µg/L, were reported in all samples.

The Final SSP Report was submitted in October 2002 and recommended No Further Action for soil and groundwater at Site 40 (CH_2M Hill, 2002). Based on results of the final SSP Report, No Further Action under a CERCLA residential use scenario was recommended and accepted by the DIRT on May 2005 and Site 40 was closed out.

SITE 43 - Higley Road Land Application Area

The Higley Road Land Application Area (known as USEPA SWMU 35) is located along Higley Road in the northeast corner of Mainside and is approximately 300 feet by 25 feet in size. In November 1989, approximately one inch of dried sewage sludge contaminated with USEPA Hazardous Waste F006 (wastewater treatment sludge from electroplating) was applied at the site. This F006-contaminated sludge was from the base sanitary sewage treatment system.

Three groundwater monitoring wells were installed and sampled in June 1991. No contamination above the regulatory limit was detected in any of the wells. Several soil samples were also analyzed; however, cadmium, in one sample, was the only constituent that exceeded a regulatory limit.

A field investigation to support an SSP was performed at Site 43 between September 2001 and October 2001 and included the following activities (CH_2M Hill, 2001a):

- Surface and subsurface soil sampling
- Monitoring well installation and groundwater sampling

One monitoring well was installed and sampled to characterize groundwater, and twelve surface soil and six subsurface soil samples were collected and analyzed. The results of the SSP field investigation indicated the presence of inorganics, SVOCs, and pesticides in the surface soil, subsurface soil, and groundwater at Site 43. No constituents were retained as COPCs for surface or subsurface soil as part of the human health risk screening. Arsenic and two pesticides were retained in groundwater, but none of the filtered arsenic concentrations were above the MCL. In addition, the presence of pesticides is attributed to facility-wide pesticide use rather than activities at Site 43. The report recommended that No Further Action be taken with regard to groundwater at Site 43. The ecological risk assessment indicated a potential risk from PAHs (primarily) and a limited number of inorganic chemicals in the surface soil at Site 43.

Based on the analytical results and risk screening, the Final SSP Report recommended a removal action for Site 43 surface soil, residual slag, metal debris, and land-farmed sludge (CH_2M Hill, 2002). As part of the removal action, data collected during the verification soil sampling will be used for comparison against human health screening criteria, ecological screening criteria, and background concentrations. An EE/CA for Site 43 has been completed and recommended removal of soil and debris from the site.

A removal action was completed during May 2004, which removed three to five inches of soil contaminated with F006-listed waste totaling approximately 251 tons. A VSAP Report indicated that soils left in place following the non-time-critical removal action met the residential RBCs established to protect human health risk. Based on the results in the final SSP Report and the Site 43 Decision Document, No Further Action under a residential use scenario was recommended and accepted by the DIRT in August 2004 and Site 43 was closed out (TtNUS, 2004e).

SITE 61a - Gambo Creek Ash Dump

The Gambo Creek Ash Dump, which is located approximately 250 feet west of Site 3 along the shoreline of Gambo Creek, was found in 1997 during the pre-design investigation for Sites 3 and 44. Items on this site include 16” and 3”/50 bag gun primers, cartridge activated devices (CAD), partially burned pyrotechnic flares, active 5” gun propellant (1.2 explosive) and charred wood, and steel cable. This material may have been deposited from one of the NSF Dahlgren ranges or from the No. 1 Powder Burn Area between 1952 and 1961. The burned ash appears to be contained in one area, about 20 feet by 30 feet in size, located at the high water mark of Gambo Creek. Some erosion of the pile is visible in a fanned-out area located in front of the pile on the Gambo Creek shoreline.

A field investigation to support an RI was conducted at Site 61a between September 2001 and January 2002 and included the following activities (CH_2M Hill, 2001a):

- Geophysical survey
- Confirmatory Trenching
- Surface and subsurface soil sampling
- Monitoring well installation and groundwater sampling
- Surface water and sediment sampling

Analytical results from the RI revealed that six inorganics (chromium, iron, lead, silver, thallium, and zinc) in the surface soil exceeded both the background and ecological screening values. Eight inorganics (beryllium, chromium, iron, lead, silver, thallium vanadium, and zinc) in subsurface soil exceeded both the background and ecological screening values. Arochlor-1260, dieldrin, heptachlor, and gamma-BHC in sediment exceeded both the background and ecological screening values. During the 2001 and 2002 sampling event, perchlorate analysis was performed on the groundwater samples collected from the marsh at Site 61a and no perchlorate was detected, using a detection limit ranging from 5 µg/L to 20 µg/L. The RI was finalized in September 2004 (CH_2M Hill, 2004c) and concluded that the waste and debris in the dump area along Gambo Creek are the primary sources of contamination, and that there are ecological risks associated with soil and sediment at Site 61a.

The Navy considered the buried debris and metallic anomalies at Site 61a to present a potential hazard that warrants remedial action. Therefore, a FFS was prepared and submitted in June 2004 (CH_2M Hill, 2004a) to address contamination from the Former Ash Dump near Gambo Creek. Three remedial alternatives were identified and consisted of no further action, excavation and off-site disposal, and capping. The second alternative (excavation, waste removal and screening, and off-site landfill disposal) was identified as the most viable option.

Based on EPA review comments on the draft FFS and discussions with the DIRT in August 2005, it was agreed that an additional investigation at Site 61a consisting of groundwater and sediment sampling is warranted to further assess the nature and extent of contamination prior to finalization of the FFS and preparation of the PRAP and ROD. A Sampling Plan was prepared in January 2006 (CH_2M Hill, 2006) to address the additional characterization requirements. Planned field and sampling activities included: UXO clearance, temporary monitoring well installation, sampling the three temporary monitoring wells and existing permanent well, and sediment sampling from seventeen locations in Gambo Creek adjacent to Site 61a. The sampling activities were completed in February and March 2006 and a Technical Memorandum-Sampling and Analysis Report Site 61a (CH_2M Hill, 2008), was submitted in February 2008.

Based on the seventeen sediment samples collected from Gambo Creek in February 2006, fourteen metals (aluminum, arsenic, barium, chromium, cobalt, copper, iron, magnesium, manganese, nickel, potassium, selenium, vanadium, and zinc) were detected in the sediment samples at concentrations that exceeded ecological screening values and/or maximum NSF Dahlgren background concentrations. Four pesticides, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT and endrin aldehyde were detected in sporadic sediment sampling locations, however the concentrations did not exceed the ecological screening values.

Analytical results for the four groundwater samples collected in March 2006, were compared to MCLs and tap-water RBCs. Nine VOCs were detected in the groundwater samples. Although the majority of VOCs were at low concentrations, TCE was detected above the MCL at GW61A-01 and carbon tetrachloride was detected above the MCL at GW61A-02. Four different pesticides were detected in two wells, with 4,4'-DDD being detected at a concentration of 1.1 µg/L in both monitoring wells, exceeding the tap-water RBC of 0.28 µg/L. 4,4'-DDT was detected in two wells at concentrations of 0.56 and 0.59 µg/L, exceeding the tap-water RBC of 0.2 µg/L. Fifteen total metals were detected; however all concentrations were below MCLs and tap-water RBCs.

The Navy prepared a work plan for the Site 61a Pilot Study. The objectives of the Pilot Study included; excavation of the two areas of visible surface debris and adjacent soil contamination, collecting floor and sidewall samples to confirm the contamination has been successfully removed, and mechanically screening the excavated materials to remove all munitions and explosives of concern (MEC) and material potentially presenting an explosive hazard (MPPEH). The overall objective is to obtain sufficient data to determine the lateral extent of soil requiring remedial action and evaluate the feasibility of excavation and mechanical screening versus the capping alternatives. An ESS and SAR are required for this project, due to the explosive hazards potentially posed by MEC and MPPEH.

The next step will be the incorporation of the above sampling results along with soil trenching and screening results into a final FSS. The FSS will determine whether capping or removal will be appropriate for Site 61a. A Workplan for excavation and mechanical screening is underway. An ESS and SAR will need to be generated prior to construction activities at the site. Once the Site 4 and 15 ESS is approved, the Site 61a ESS will be initiated.

SITE 62 - Building 396

Building 396, located at Terminal Range, was used for oil and gun cleaning fluid storage associated with explosive testing activities. An interior cleaning sink drains to a French drain located on the west side of Building 396. Building 396 was no longer in use and was demolished prior to the remedial activities in

2001. A Site Characterization Report was completed by Geophex (Geophex, 1997). The objective of the Site Characterization Report was to determine if soil and groundwater had been impacted by historical releases of oil and gun cleaning fluids and to provide recommendations for remedial action.

The site characterization included soil borings, three of which were converted to temporary monitoring wells. Soil and groundwater samples were analyzed for benzene toluene ethylbenzene xylenes (BTEX), TPH, diesel range organics (DRO), gasoline range organics (GRO), SVOCs, VOCs, PCBs, and RCRA Metals.

Contaminants detected in the soil and groundwater (acetone, 2-butanone, and methylene chloride) are consistent with solvent releases. Lead detected in the groundwater samples exceeded the MCL action level of 0.015 mg/L, and other metals detected were below MCLs. The source of the contaminants is most likely associated with Building 396 operations.

A field investigation to support an RI was conducted between September and October 2001. Field activities at this site included the following (CH_2M Hill, 2001a):

- Surface and subsurface soil sampling
- Surface water and sediment sampling
- Monitoring well installation and groundwater sampling

Antimony, arsenic, chromium, manganese, and thallium are the COPC, and screening-level exceedances occurred in the six surface soil sampling locations at the site. None of the RI results exceeded screening criteria for VOCs, SVOCs, metals, and PCBs. Nine total (aluminum, arsenic, cadmium, chromium, iron, lead, manganese, thallium, and vanadium) and two dissolved (arsenic and iron) metals were detected and are surface water COPC. During a 2002 sampling event, perchlorate analysis was performed on the groundwater samples collected at Site 62. Non-detected results, using a detection limit of 4 µg/L, were reported in the samples. The RI/FS report was finalized in May 2005 (CH_2M Hill, 2005a). The risk assessment portions of this report determined that there are no unacceptable risks associated with soil, groundwater, surface water, and sediment at Site 62.

An EE/CA, which was finalized in December 2004 (CH_2M Hill, 2004b), focused on a French drain that had received various chemical wastes generated from gun cleaning activities on the northwest side of Building 396. The EE/CA recommended removal of the French drain and surrounding soil. This non-time critical removal action was performed in December 2004. Verification results were compared to the EE/CA PRGs, and in December 2004 the DIRT determined that this removal action addressed the source of contamination and that no unacceptable risks remained for soil and groundwater at Site 62.

The Site 62 PRAP recommended no further action and was issued in early May 2005 and the associated public comment period was held from May 9, 2005 to June 8, 2005. The public meeting was held on May 17, 2005 and one comment was received and addressed. A no further action ROD was finalized in August 2005 and the DIRT recommended that this site be closed out.

2.5 PRIORITY 4 SITES

SITE 1 - Old Bombing Range and SITE 5 – Projectile Disposal Area

IAS Site 1, identified as “AOC J” and referred to as the “Old Bombing Range” in Appendix A of the NSF Dahlgren FFA, is located within the boundaries of the Missile Test Range in the central part of Mainside in NSF Dahlgren. The site is approximately 293 acres in size, and is currently wooded and vegetated. The site was more actively used in the early 1940s as an aerial bombing range.

IAS Site 5, identified as “SSA #51” and referred to as the “Projectile Disposal Area” in Appendix A of the NSF Dahlgren FFA, is located within the boundaries of the Terminal Range, north of Building 934 at NSF Dahlgren. Site 5 was included in the FFA based on the verbal report of potential disposal of projectiles. No specific disposal location was indicated, just a general description of an area on Terminal Range. The site is approximately 2.53 acres in size, and is mostly vegetated with grass, except in areas previously developed or disturbed. The site is reported to have been a wetland filled in with construction rubble, projectiles, fill dirt and ordnance probably coming from others areas on the range. Disposal reportedly occurred during the late 1930s or early 1940s.

As both Sites 1 and 5 are located within the boundaries of active test ranges, it is the consensus of the Navy, the USEPA Region III, VDEQ, and members of the DIRT that these sites require no action under the NSF Dahlgren FFA. Due to constraints on the Navy’s Environmental Restoration (ER,N) program, ER,N funds are not authorized for cleanup actions at these operational ranges, as provided in the document entitled Department of the Navy Environmental Restoration Program Manual, Section 4.2.1, Response Eligibility Criteria, pages 4 through7. Any necessary cleanup of sites within operational ranges is conducted pursuant to applicable laws and regulations upon any subsequent closure or transfer of the relevant range, as provided in the document entitled “DoD and EPA Interim Final Management Principles for Implementing Response Actions at Closed, Transferring, and Transferred Ranges”, dated 7 March 2000. Based on this decision, potential action at both sites is deferred until the ranges are closed or transferred.

Based on the contents of the September 2007 Decision Document, the location of Sites 1 and 5 will remain marked on the installation's geographical information system (GIS) in order to prevent incompatible land uses, other than range operations. Any changes in land use will be evaluated and approved for inclusion in the installation's Regional Shore Infrastructure Plan (RSIP), which documents current and anticipated land uses within the installation. The Commander in charge of the ranges has been notified of this document and concurs with its decision.

SITE 36 - Depleted Uranium Mound, Pumpkin Neck

The DU Mound, Pumpkin Neck, Site 36 (also known as USEPA Other Units C1) was located in the EEA, in the Harris Range. It was approximately 80 feet in diameter and 12 feet high. The site was a grass-covered pile of earth where rounds of 20-millimeter DU shells are imbedded. The DU shells were fired into the mound to test trajectory. The site began operation sometime in the 1970s and was active until 1990. Site 36 was originally on the west side of Harris Test Road but was relocated to the east side in 1985.

A Site Characterization and an EE/CA were performed for this site (Allied Technology Group, Inc. and Geo/Resource Consultants, Inc., 1997). The risk-driver for Site 36 was DU, including U-238 and daughter decay products Th-234 and Pa-234m. Other metals and contaminants at detected concentrations were not considered to pose a significant threat to human health and the environment. The cleanup level for DU was proposed at 35 pico curies per gram (pCi/g) of U-238 activity based on Federal Register 23 October 1981, Vol. 46, No. 205, and NRC Guidelines entitled "Guidelines For Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses For Byproduct, Source, or Special Nuclear Material", July 1982.

The removal action was conducted in February 1998, and several M-46 grenades were found during the excavation. Due to the extreme hazard of the grenades, a pilot-scale screening study was initiated in March 1998 in order to remove the grenades from the DU soil pile. The pilot-scale proved successful and was implemented to remove all of the grenades. Once the grenades were removed, the soil was placed in piles on plastic sheeting for scanning to determine if contamination still existed in the soil and if the release criteria (i.e., 35 pCi/g, U-238) were met. A final status survey was conducted to confirm the DU contamination was removed from the site. During this final survey, the affected areas were marked off in 10 meter (m) by 10 m grids, and a gamma scan was performed to locate any areas of elevated direct radiation. IT/OHM took several verification samples from each grid to confirm the results of the gamma scan. DU penetrators and contaminated soil were removed from the mound at Site 36 and placed in 55-gallon drums. Once confirmation samples results were received, the drums containing the DU were shipped to a permitted facility and the remaining uncontaminated soil at Site 36 was leveled to grade. Site 36 and Site 49 were combined into one RI/FFS because removal actions were completed for both sites due to the presence of DU. The following items summarize the results of the human health risk assessment conducted based on the soil sampling results:

- Cumulative hazard indices calculated for all potential receptors, i.e., base workers, construction workers, and hypothetical future residents (adults and children), who might be exposed to soil at Site 36 do not exceed one (1), indicating that adverse health effects are not anticipated under the conditions established in the exposure assessment.

- Total cancer risk estimates for metals (arsenic) and radiation from DU for these receptors are within the USEPA target risk range or 1.0 $x10^{-4}$ to 1.0 x 10^{-6}. Arsenic is the only carcinogenic metal evaluated. However, arsenic results reported are pre-excavation results and may not reflect actual site conditions. The radiological risks calculated from post-removal DU results are less than the USEPA target risk range.

The results of the qualitative ecological risk assessment indicated that, as with the case of human health, uranium was the ecological risk-driving chemical selected as a Chemical of Potential Ecological Concern for Sites 36 and 49. Due to the uranium's reasonable maximum exposure concentration (practically the maximum detected value) at Site 49 was slightly higher than the value determined for Site 36, only one set of calculations was performed in the quantitative ecological risk assessment. The results reported for Site 49 are considered to be representative of Site 36 conditions as well. For bald eagles, which represent the assessment end point of the quantitative ecological risk assessment, a toxicity quotient for the reasonable maximum exposure case was estimated to be 8.8 x 10^{-4} for Site 49. This value indicated that pre-removal DU contamination at Site 49 did not seem to pose any adverse effects to this federally endangered species. Even if there were additive effects posed by DU at Site 36 (for example, these two sites are within the home range of bald eagles), the overall effect (an increase of up to a factor of two) was still insignificant.

A PRAP was prepared for Site 36 and Site 49 recommending no further action be taken at these sites. The PRAP and a public notice were issued announcing the public comment period starting July 20, 2001 and ending August 19, 2001. No comments were received during the 30-day public comment period or at the Public Meeting held on July 24, 2001. The Navy and USEPA signed a ROD in September 2001, with VDEQ issuing a concurrence letter (U.S. Navy, 2001d).

In January 2002, NFS Dahlgren received a letter from the NRC stating that Site 36, Depleted Uranium Mound, Pumpkin Neck, and Site 49, Depleted Uranium Gun Butt, met the criteria for unrestricted use described in 10 CFR 20.1402 (NRC, 2002).

SITE 47a - W.W.I Munitions Mound

W.W.I Munitions Mound (known as USEPA SWMU 50) is located just east of Higley Road, approximately 100 feet west of the Potomac River at Mainside. It is approximately 0.5 acres in area and approximately 20 feet to 30 feet in height. The mound is fully vegetated with grass, shrubs, and concentrated patches of certain weeds.

The W.W.I Munitions Mound was used from about 1917 to the late 1930s. Live and dud W.W.I munitions were piled up and covered with dirt, forming a mound. It is not known whether the munitions were buried below grade or piled on top of the ground. No liquid wastes were placed in the mound, although it is open to precipitation.

As part of the investigation to support an EE/CA, a geophysical study and a surface and subsurface soil investigation were completed in February 2002. The geophysical study was completed to delineate areas containing munitions at Site 47a. The surface and subsurface soil sampling was completed primarily around the perimeter of Site 47a. Trenching was also performed to determine the extent of subsurface contamination. Perchlorate analysis was performed on the groundwater samples collected from an open trench at Site 47a during 2002. No perchlorate was detected in the sample using detection limit of 1 µg/L.

The EE/CA for Site 47a was completed in July 2003 (TtNUS, 2003h). A semi-quantitative human health risk assessment was performed for potential industrial and residential receptors at Site 47a. The results of the risk analysis indicated that potential risks are within or less than USEPA acceptable levels. A qualitative ecological risk screening, performed at the site indicated a potential ecological risk to soil invertebrates and plants associated with direct exposure to PAHs and metals in surface soil. The EE/CA concluded that there is potential risk to the environment from contaminants associated with waste at the site and the selected remedial action consists of excavation, screening, reuse and off-site disposal of contaminated soil, metal scrap and debris, and site restoration.

Due to the known presence of significant amounts of UXO materials, the excavator was equipped with a remote control unit with a 3,000 foot wireless link between the operator and the machine to ensure safety of the site workers. Remote control excavation of soil and debris began in Spring 2004 following mobilization of the excavator, screening plant with magnetic separation, and a shelter/control building. A total of eighteen separate sub-areas were excavated and sampled. Chem Tec Labs analyzed the samples and provided a report that concluded that approximately 366 CY of soil was found to be contaminated with elevated levels of several metals (i.e., arsenic, chromium and nickel) that exceeded the BTAG screening criteria. The contaminated soil, located at stockpile sample PL05, was disposed of offsite in an approved disposal facility. Following the sampling, all the remaining soil removed was returned to the excavation. The average depth of excavation was approximately 6.5 feet. Materials encountered during excavation included:

- 9,570 cy of soil
- 7,695 pounds scrap metal
- 166 ordnance items

The remedial action was completed in December 2005. A Post Removal Action Report was completed in Spring 2006. The report states that all soil that was removed from the site for disposal at the King and Queen Landfill located in Little Plymouth, Virginia was free of UXO and explosive material; and that all ORS was inspected and certified to be free of UXO and explosive materials by the Senior UXO Supervisor (SUXOS) and NSF Dahlgren G64 personnel prior to transfer to the NSF Defense Reutilization Marketing Office.

The site Close-Out Document for Site 47a was completed in November 2006. The conclusions of the Close-Out Document state that based upon the 2004 and 2005 verification sampling results, the DIRT determined that excavation was complete at Site 47a. Based on characterization sampling results, the DIRT determined that excavated SA05 soil (stockpile PL05) should be disposed of off-site due to elevated levels of arsenic, chromium, and nickel. The remaining soil was acceptable and was used for general backfill at the site.

Based on data presented in the site Close-Out Document, the RPMs concluded that Site 47a requires no further action under a residential use scenario under CERCLA.

SITE 47b - EOD Scrap Area

The EOD Scrap Area, Site 47b (known as USEPA AOC K) consists of scrap metal and debris containing various metals, wood, electrical equipment, Styrofoam, pipe conduit, glass shards, and an 8-inch shell. The area is sparsely vegetated and located approximately 100 feet west of the Potomac River and 470 feet east of Tisdale Road. The site is currently operational and its use predates 1950. It is not known whether live ordnance exists in the area, but the probability is high.

The EE/CA for Site 47b was performed concurrently with Site 47a and was completed in July 2003 (TtNUS, 2003h) Sampling data indicate contaminant releases have occurred at 47a, and because the materials at Site 47b may be similar to those at Site 47a, contaminants are likely to be present at Site

47b. Both sites contain waste in place that may pose a risk to human health and the environment from the continued effects of erosion and other transport mechanisms.

The EE/CA recommended excavation, screening, reuse and off-site disposal for Site 47b. Excavation operations began in February 2005 which included seven trenching areas to identify the depth of potential ordnance related materials. Materials encountered from the excavation included:

- 650 CY of contaminated soil, which was removed from the site on May 16, 2005,
- 6,490 pounds scrap metal
- 1,100 pounds of OE metal scrap items
- A 1,100-gallon UST, which was not leaking due to the presence of product inside,
- A 20 x 20 x 1 foot thick concrete slab

Clean soil has been brought in to backfill the excavation and the remediation was completed in May 2005. Screening operations and decontamination of the mechanical screener were completed in December 2005. A Post Removal Action Report was completed in September 2006. The report states that all soil that was removed from the site for disposal in the King and Queen Landfill located in Little Plymouth, Virginia was free of UXO and explosive material; and that all OE related scrap was inspected and certified to be free of UXO and explosive materials by the SUXOS and NSF Dahlgren G64 personnel. During Fall 2006, the scrap material was taken to the EEA, awaiting transfer to the NSF Defense Reutilization Marketing Office.

The Close-Out Document for Site 47b was completed in November, 2006. The conclusions of the Close-Out Document state that excavation was complete at the Site 47b exposure area and UST areas. The DIRT also decided that excavated EA soil and UST Area soil should be disposed off-site, as verification sample results indicated SVOCs and some metals concentrations greater than the screening criteria. The Turkey Trot soil stockpile (excluding the northeastern corner area) was deemed acceptable for use as excavation backfill below grade, and the Burgess Borrow Pit soil was deemed acceptable for general backfill and topsoil.

Based on data presented in the site Close-Out Document, it was the consensus of the RPMs that Site 47b requires no further action under a residential use scenario under CERCLA.

SITE 49 - Depleted Uranium Gun Butt

The Depleted Uranium Gun Butt, Site 49 (also known as USEPA Other Units C4) was located east of Building 200. This unit was an open steel sand butt used to test DU shells. The butt was designed so that fired projectiles expended their energy in the sand. A portion of the projectile was pulverized or abraded on impact, resulting in a dust of metal and pulverized sand. This unit began operation in the 1940s. Prior to July 1991, the firing range butt was used for DU munitions tests. The butt is no longer in use. It consisted of a large steel rectangular box (24 feet wide by 51 feet deep and 15 feet high) with a vertical open face containing approximately 13,000 cubic feet of sand and approximately 3,500 DU projectiles. The butt was constructed of steel armor plate approximately four inches thick.

A Site Characterization and an EE/CA were performed for this site (Allied Technology Group, Inc., and Geo/Resource Consultants, Inc., 1997). The risk-driver for Site 49 was DU, including U-238 and daughter decay products Th-234 and Pa-234. Other metals or contaminants at detected concentrations were not considered to pose a significant threat to human health and the environment. The cleanup level for DU was proposed at 35 pCi/g of U-238 activity, based on Federal Register 23 October 1981, Vol. 46, No. 205, and NRC Guidelines entitled "Guidelines For Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses For Byproduct, Source, or Special Nuclear Material," July 1982.

In June 1998, the DU gun butt decontamination was essentially complete. Confirmatory samples indicated that cleanup goals were achieved; however, regulatory agencies performed a final review of the site when Site 36 was complete, so that they could be reviewed together.

An RI/FFS for Sites 36 and 49 was submitted in July 2001. The two sites were combined into one RI/FFS because a removal action was completed at both sites due to the presence of DU. The following items summarize the results of the human health risk assessment conducted based on the soil sampling results:

- Cumulative hazard indices were calculated for all potential receptors, i.e., base workers, construction workers, and hypothetical future adult residents, who are exposed to soil and groundwater at Site 49 do not exceed unity (1), indicating that adverse health effects are not anticipated for these receptors under the conditions established in the exposure assessment. The hazard index for a child resident exceeds one (1) from exposure to manganese in groundwater. However, the presence of manganese is likely due to natural processes and is not considered a site-related contaminant.

- Total cancer risk estimates for metals (arsenic) and radiation from DU for these receptors are within the USEPA target risk range of 1.0×10^{-4} to 1.0×10^{-6}. Arsenic was the only carcinogenic metal evaluated. However, arsenic results reported are pre-excavation results and may not reflect actual site conditions. The radiological risks calculated from post-removal DU results are also within the USEPA target risk range.

- The contaminants of potential concern for groundwater concentrations reported for Site 49 do not exceed current the Federal Safe Drinking Water Act primary (health-based) MCLs. The secondary (aesthetic-based) MCL for manganese is exceeded.

The results of the qualitative ecological risk assessment indicated that, as with the case of human health, uranium was the ecological risk-driving chemical selected as a Chemical of Potential Ecological Concern for Sites 36 and 49. Because the uranium reasonable maximum exposure concentration (practically the maximum detected value) at Site 49 was slightly higher than the value determined for Site 36, only one set of calculations was performed in the quantitative ecological risk assessment. The results reported for Site 49 are considered to be representative of Site 36 conditions as well. For bald eagles, which represent the assessment end point of the quantitative ecological risk assessment, a toxicity quotient for the reasonable maximum exposure case was estimated to be 8.8×10^{-4} for Site 49. This value indicated that pre-removal DU contamination at Site 49 did not seem to pose any adverse effects to this federally endangered species. Even if there were additive effects posed by DU at Site 36 (for example, these two sites are within the home range of bald eagles), the overall effect (an increase of up to a factor of two) was still insignificant.

A PRAP was prepared for Site 36 and Site 49 recommending no further action be taken at these sites. The PRAP and a public notice were issued announcing the public comment period starting July 20, 2001 and ending August 19, 2001. No comments were received during the 30-day public comment period or at the Public Meeting held on July 24, 2001. The Navy and USEPA signed a ROD in September 2001, with VDEQ issuing a concurrence letter (U.S. Navy, 2001d).

In January 2002, NFS Dahlgren received a letter from the NRC stating that Site 36, Depleted Uranium Mound, Pumpkin Neck, and Site 49, Depleted Uranium Gun Butt, met the criteria for unrestricted use described in 10 CFR 20.1402 (NRC, 2002).

3.0 APPENDIX B SITES

This section discusses sites that are collectively called Appendix B sites and are listed in Table 3-1. Table 3-1 contains the current status of each of these sites. At the February 2003 meeting, the DIRT agreed to add Building 126 to Appendix B based on potential contamination remaining at the site. As stated in Section 2.0, Site 61b was transferred from an Appendix A to an Appendix B site in May 2003. At the May 2007 meeting, the DIRT agreed to add the Building 198 Neutralization Tank to Appendix B based on potential contamination remaining at the site.

Under the FFA, the Navy has agreed to provide additional site information, which may include sampling, for review by USEPA Region III and VDEQ. Based on a desktop evaluation, these units will be proposed for “no further action” or transferred to Appendix A with the approval of the Navy, USEPA Region III, and VDEQ. The Navy will then prepare a brief “close-out” document on units requiring “no further action”. Unit descriptions presented in this section are based on existing information. If appropriate and the Parties agree, the Navy may initiate a cleanup of the unit. If a cleanup is performed, the Navy will provide confirmatory sampling in a close-out report to the USEPA Region III and VDEQ for approval.

SWMU 3 - Building 194AA (Concrete Pad)

This unit (SWMU 3) was a black drum on an eroding concrete base surrounded by grass. The unit was located on a severely deteriorated concrete pad. In addition, the unit was not equipped with curbing or diking to provide adequate containment in case of a release. One drum of used aircraft oil was removed from the concrete pad.

Field investigation activities at the site consisted of Pre-Excavation and Post-Excavation sampling. Pre-Excavation sampling consisted of four surface soil (0 to 12 inch) samples at the perimeter of the concrete base; the samples were analyzed for PCBs and TPH. Risk was evaluated under the residential and industrial use scenarios based upon initial soil sampling results, which included inorganics, PCBs, and TPH contamination. A cleanup was identified and performed in March 1996. During the cleanup action, when the concrete pad was removed, a slight petroleum odor was noted. The pad thickness varied from 12 to 20 inches. A 20 foot by 23 foot area surrounding the pad was excavated and removed to a depth of 14 to 24 inches. Approximately 36 tons of concrete and soil were removed from the unit and disposed of off-site at a permitted facility.

TABLE 3-1

**APPENDIX B SITES
NSF DAHLGREN
PAGE 1 OF 2**

Site No.	Site Name	Current Phase (as of June 15, 2007)	Close-out Indust./Res.
SWMU 3	Building 194AA (Concrete Pad)	Closed Out	Res.
SWMU 15	Building 120B Contractor Staging Area	Closed Out	Indust.
SWMU 20/Site 41	Compost Area	Closed Out	Res.
SWMU 23	Building 456 Oil Waste Drum	Closed Out	Res.
SWMU 27	Tank 280 Contractor Staging Area	Closed Out	Res.
SWMU 57/Site 60	Building 445 Star Gauge Loading Dock	Closed Out	Res.
SWMU 61	Paint Can Crusher	Closed Out	Res.
SWMU 62	Paint Can Dumpster	Closed Out	Res.
SWMU 64	Building 448 Sand Blast Area	Closed Out	Res.
SWMU 67	Building 448 Tar Tank Area	Closed Out	Res.
SWMU 70	Building 152 TCA AA	Closed Out	Indust.
SWMU 77	Building 1329 Wash Area	Closed Out	Res.
SWMU 78	Building 1121 Former Waste Oil UST	Closed Out	Res.
SWMU 82	Electroplating Line and WWT	Closed Out	Res.
SWMU 101	Building 155 Auto Shop Waste Oil Filter and UST	Closed Out	Res.
SWMU 115	Building 1282 Auto Hobby Outside Used Oil Storage	Closed Out	Res.
SWMU 119	Building 1282 Auto Hobby Used Oil Tank	Closed Out	Res.
SWMU 125/Site 52	OWS 107-350 (Yardcraft Area)	Closed Out	Res.
SWMU 127	OWS 1121-300, OWS 115-350, OWS 402-30,000, and OWS 486-1000	Closed Out	Res.
SWMU 128/Site 54	OWS 1121- Old	Closed Out	Res.
SWMU 130	Yardcraft Oil Storage Area	Closed Out	Res.
SWMU 131/Site 28	Gambo Creek Compost Area	Closed Out	Res.
AOC A	Otto Fuel Spill	Closed Out	Indust.
AOC O	Building 1369 Pesticide Spill Area	Closed Out	Res.

TABLE 3-1

**APPENDIX B SITES
NSF DAHLGREN
PAGE 2 of 2**

Site No.	Site Name	Current Phase (as of June 15, 2007)	Close-out Indust./Res.
AOC X	Classified Documents Incinerator Sewage Holding Tank	Closed Out	Res.
AOC X7/Site 39	Open Storage Area Main Battery	Closed Out	Indust.
AOC Z	Terminal Range Building 109	Closed Out	Res.
Other Units C3	Scar at Phalanx Test Area	Closed Out	Res.
Other Units C6	Former Radio Testing Area	Closed Out	Res.
Additional Areas X6	South Hangar Former Tank Area	Closed Out	Res.
Site 59	Octagon Pad Dump, EEA	Closed Out	Res.
Building 126	Former Powder Magazine	Closed Out	Res.
Site 61b	Gambo Creek Projectile Disposal Area	Closed Out	Res.
	Building 198 Neutralization Tank	Sampled	

Closed out - A close-out document is available and no further action is required for this site.
Indust. - Industrial Scenario
Res. - Residential Scenario
Sampled - Site sampled, awaiting results/decision

Post-Excavation sampling consisted of one surface soil sample analyzed for RCRA metals, PCBs, and TPH, and a groundwater sample analyzed for TPH and PCBs. No chemicals exceeded the RBC screening criteria. Non-detected results were obtained for TPH and PCBs in the groundwater sample.

Based upon confirmation soil and groundwater sampling, modifications to the operations of the site, and the removal of the source area, no further action is required for this unit, based on a residential use scenario under CERCLA (U.S. Navy, 1999a).

SWMU 15 - Building 120B Contractor Staging Area

Building 120B Contractor Staging Area (SWMU 15) was located north of Building 120B at Mainside. The site consisted of an office trailer and drums stored on the ground. The area encompassed approximately one acre and was used from Spring to Fall 1992. The drums included used diesel fuel, used motor oil products, scrap metal, and wood. The drums were also and used while a contractor was working on a construction project at NSF Dahlgren. The contractor removed the drums when the construction project was completed.

Field investigation activities at the site included collecting a total of five surface soil samples. These samples were analyzed for PCBs, TPH, benzene, toluene, ethyl benzene, and BTEX. Risk was evaluated under residential and industrial use scenarios.

Arsenic, barium, PCBs, and selenium were noted as COCs. Arsenic was considered not to be significantly elevated above background levels. One soil sample for selenium was reported at an elevated detection limit above screening levels for groundwater; however, selenium was not detected in the remaining four samples and the detection limits were below the screening level. Barium was reported above the groundwater screening levels, but below background levels. PCBs were detected; however, the reported concentrations were within the industrial cleanup levels under an USEPA PCB Spill Cleanup policy. Elevated levels of TPH were detected in sampling; however, the corresponding volatile organic compounds were not detected.

Maximum concentrations of chemicals from soil sampling were compared to RBC tables, to screening levels for residential and industrial use, and to Soil Screening Levels (SSL) for the protection of groundwater. Arsenic, barium, PCBs, and selenium were noted as COCs. Arsenic was considered not to be significantly elevated above background levels. One soil sample for selenium was reported above screening levels for groundwater; however, selenium was not detected in the remaining four samples. Barium was reported above the groundwater screening levels, but below background levels.

PCBs were detected; however, the reported concentrations were within the industrial cleanup levels under an USEPA PCB Spill Cleanup policy. Elevated levels of TPH were detected in sampling; however, the corresponding VOCs were not detected.

The few potential COCs that were elevated slightly above RBC/SSL values are not expected to present a significant risk as long as site use remains limited to industrial activities. Based on the contents of the Site Close-Out Document, it is the consensus of the Remedial Program Managers that this site requires no further action under a continued industrial use scenario (U.S. Navy 1996a).

SWMU 20/Site 41 - Compost Area

The Compost Area (known as USEPA SWMU 20) was located in the central section of Mainside. It consisted of four mounds over approximately a 2 acre area. Three of the mounds are approximately 30 feet in diameter and 15 feet high, and one mound is approximately 50 feet in diameter and 15 feet high. From the 1960s until the Fall of 1992, wood chips, mulch, sawdust, leaves, and similar materials were dumped on the ground in the four areas, eventually forming the four mounds of compost material. These mounds were leveled in October 1994 to discourage further use.

The Compost Area was sampled in Summer 1999 at the same time as the verification sampling for Site 9. Based on the nature and history of the compost piles, analysis of the samples collected from three of the four compost piles was limited to TAL metals plus cyanide and target compound list (TCL) Pesticides/PCBs. In addition to these analytes, Pile 3 also was sampled for TPH. Four discrete samples were collected from each of the compost piles to evaluate the contamination levels within the piles. The results of the sampling indicated that the material could not be used based on concentrations of DDT in Pile 3. No further work was performed on the piles until 2001. At that time, the RPMs decided that Piles 1 and 2 could be used for compost and backfill at AOC Z. At the same time, the hot spot of DDT located in Pile 3 was removed and disposed off-site.

Following the removal of the hot spot in Pile 3, TtNUS re-sampled Piles 3 and 4 in 2001 following the same procedure used to sample the piles in 1999. The re-sampling was designed to confirm that pesticide concentrations met appropriate screening levels to help determine if the material could be used as topsoil at the facility. Based on the re-sampling results, the 2002 Analytical Sample Summary Report concluded that the compost was suitable for use as topsoil at the facility (but not within the buffer zone around or within wetlands as a conservative measure, based on sediment guidelines for DDT), and that no further investigation of Site 41 was necessary.

Based on the contents of the Site Close-Out Document, it was the consensus of the RPMs that this site requires no further action under a residential use scenario (U.S. Navy, 2002h).

SWMU 23 - Building 456 Oil Waste Drum

The Building 456 Oil Waste Drum (SWMU 23) was located outside the eastern side of Building 456, the Boiler House at Mainside. The 55-gallon drum was situated on the ground and did not have any secondary containment.

The drum was used in August 1992 to contain oily rags, papers, empty oil cans, and other wastes associated with UST installation. The drum and wastes were removed in August 1992. During the Navy Site Visit, an area of darkened soil approximately eight inches in diameter was noted in the area where the drum stood.

Field investigation activities at the site included collecting a total of four surface soil (0 to 12 inches) samples. These samples were analyzed for total metals, PCBs, and TPH. Risk was evaluated under residential and industrial use scenarios.

Although aluminum, arsenic, iron, and manganese were above residential screening levels, they were all within background levels of the facility. Beryllium was reported at a higher detection limit than the screening level, however, is not expected to be a constituent at the SWMU unit after calculating the risk at one half the detection limit. One of the four samples contained a slightly elevated level of PCBs; however, it does not appear that PCBs are a principal component of any releases in this small area. Consequently, existing levels do not warrant further action. One of the four samples also exhibited elevated TPH concentrations; however, since this site was subject to an UST cleanup and the samples were at the closest edge of the building, further action does not appear to be warranted.

Based on the foregoing and considering current and planned future use, the RPMs believe the existing data is adequate to estimate risk at this site. The few potential chemicals, which are slightly above risk based concentration values, are not expected to present a significant risk for a residential use scenario.

Based on the contents of the Site Close-Out Document, it was the consensus of the RPMs that this site requires no further action under a continued industrial use or a future residential use scenario (U.S. Navy, 1996e).

SWMU 27 - Tank 280 Contractor Staging Area

The Tank 280 Contractor Staging Area (SWMU 27) was located north of Buildings 280 and 323 (the Pump House) at Mainside. It was approximately one acre in size and used from Spring to Fall 1992.

Three 55-gallon steel drums and five 4-gallon plastic drums were stored on the ground in this staging area. The drums contained waste oil, oily rags, oil product, and possibly diesel fuel that a contractor was using while working in the vicinity.

Fourteen soil samples and three sediment samples were analyzed for TCL VOCs, SVOCs, TAL metals, pesticides/PCBs, and hexavalent chromium. There were few exceedances of screening criteria and none of them were significantly above the criteria. No further action, under a CERCLA residential use scenario, is recommended for this site.

SWMU 57/Site 60 - Building 445 Star Gauge Loading Dock

The Building 445 Star Gauge Loading Dock (SWMU 57) was located east of Building 445, at Mainside. It had been used since the 1940s for the storage and handling of paint residues and gun barrel preservative containing tar and petroleum-based solvent.

The Building 445 Star Gauge Loading Dock (SWMU 57) consisted of a U-shaped concrete loading dock with a below-grade entrance. The sides of the squared-off "U" measured approximately 30 feet and the base measured approximately 15 feet. A drain at the base of the loading dock wall, within the concrete below-grade entrance, led to the storm sewer. At the time of the Navy Site Visit, small paint and gun barrel preservative stains were visible on the concrete floors of the dock and the entrance.

Field investigation activities at the site included collecting four surface soil samples (0 to 12 inches) within the concrete loading dock basin, and analyzing the samples for TPH and VOCs. Detected chemicals include inorganics, one VOC (1,1,1-TCA), and TPH. Risk was evaluated under the residential and industrial use scenarios, based upon the soil sampling results. A cleanup was identified and performed in March 1996. The cleanup action consisted of: removing sediment from the loading ramp, scraping loose paint and tar from the walls, and cleaning the walls and the loading ramp area with a high-pressure washer system. Since the concrete base and walls of the loading dock area were not compromised, it is unlikely that contamination would have spread beyond the loading ramp area.

Based on the source removal, new storage and handling procedures for hazardous material and professional judgment, no further action is required for this unit and no restrictions apply under CERCLA (U.S. Navy, 1999b).

SWMU 61 - Paint Can Crusher

The Paint Can Crusher (SWMU 61) was located east of Building 482 at Mainside and was used for crushing empty paint cans prior to their disposal. The unit consists of a steel hydraulic press that punctured and crushed empty paint cans and an area used to stage empty uncrushed paint cans. This unit was located on asphalt and did not have secondary containment. The empty paint cans were generated in Building 482 (Paint Shop) and were moved outside to the Paint Can Crusher (SWMU 61). The paints primarily used in the Paint Shop are oil based enamel and water based latex. No lead based paints are used in the paint shop.

The Paint Can Crusher (SWMU 61) began operation around 1986 and ceased operation at the outside location during the summer of 1993. During the Summer 1993 this unit was moved inside Building 482, and a steel drip pan was installed underneath the crusher.

The topography around Building 482 slopes gently to the east. Surface water runoff drains overland to a topographic low approximately 100 feet to the northeast.

A total of twelve soil grab samples and one field duplicate were collected from five soil borings during a field investigation conducted between in July 1993. A detailed description of the sample locations, the samples collected, and the rationale for their collection is provided in the 1993 SSP Work Plan (Halliburton NUS, 1993a). Twenty inorganic constituents were detected in surface and subsurface soil samples collected from the vicinity of the Paint Can Crusher (SWMU 61). With the exception of lead, all metals were below any regulatory level that would require action. Lead levels of 540 ppm and 750 ppm were found in two samples in SWMU 61. These levels are within the 500 to 1,000 ppm cleanup range for lead established by the USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.4-02 for residential settings. Therefore, based on the nature and level of lead contamination, the current and proposed future land use, and the site conditions, no further action at SWMU 61 was proposed (Halliburton NUS, 1993b).

The sampling results indicate that most of the constituent levels do not exceed RBCs. Although the maximum concentration of some constituents exceeded screening criteria, the site soils have since been removed as part of sewage treatment plant improvements. Based on the contents of the September 2001

Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario (U.S. Navy, 2001b).

SWMU 62 - Paint Can Dumpster

The Paint Can Dumpster (SWMU 62) was located southeast of Building 482 and is currently located east of Building 482 at Mainside. It was used for storage of crushed paint cans and related paint shop waste prior to disposal. The 10 cubic feet (ft^3) metal dumpster rests on asphalt. Paint stains mark the interior of the dumpster, and there is a drainage hole on the right side of the dumpster.

From the 1980s to July 1993 the Paint Can Dumpster (SWMU 62) was located southeast of Building 482. In July 1993 it was moved approximately 25 feet to a location east of Building 482. At this time the drain was plugged and a tarp placed on top of the unit.

Four soil grab samples and one duplicate were collected from four auger points at the previous location during a field investigation conducted in July 1993. A detailed description of the sample locations, the samples collected and the rational for their collection is provided in the SSP Work Plan (Halliburton NUS, 1993a).

Maximum concentrations of chemicals from soil sampling were compared to RBC Tables, to screening levels for industrial and residential use scenarios, and to soil screening levels for the protection of groundwater.

Risk was evaluated under the residential and industrial use scenarios, based upon initial soil sampling results. These results indicate that most of the contaminant levels did not exceed RBC Tables, except for arsenic, benzo(a)pyrene, barium, and chromium. Arsenic and benzo(a)pyrene slightly exceeded background levels and RBC tables. Arsenic was within overall background levels, and benzo(a)pyrene only slightly exceeded RBC levels for residential use. Barium and chromium exceeded the soils to groundwater screening criteria; however, it was determined that these constituents are not problematic given the site conditions.

Based on soil sampling results, removal of the dumpster and Building 482, and the addition of the asphalt parking lot, no further action was recommended for this unit for a residential scenario under CERCLA (U.S. Navy, 1999d).

SWMU 64 - Building 448 Sandblast Area

The Building 448 Sandblast Area (SWMU 64) was an unmarked area located south of and outside Building 448 on a paved surface at Mainside. This area was used for sandblasting paint off approximately 100 household radiators during August 1992. There is residual sandblast grit around the unit and along the edge of the paved area. The slightly undulating topography around Building 448 slopes to the south, and a wetland filter area occurs approximately 300 feet to the south.

A total of ten soil grab samples and one field duplicate were collected during a field investigation conducted in July 1993. A detailed description of the sample locations, the samples collected, and the rationale for their collection is provided in the SSP Work Plan (Halliburton NUS, 1993a). No contamination was detected or found to exceed ARARs at the Sandblast Area (SWMU 64).

Maximum concentrations of chemicals from soil sampling were screened against RBC tables, screening levels for industrial and residential use scenarios, and soil screening levels for the protection of groundwater. Risk was evaluated under the residential and industrial use scenarios, based upon initial soil sampling results. These results indicated that the contaminant levels did not exceed RBC tables, except for arsenic, barium, chromium, and nickel. Arsenic slightly exceeds RBC tables, however, concentrations were within overall background levels. Barium, chromium, and nickel concentrations exceeded the soil to groundwater screening criteria; however, it is not expected that these constituents are problematic since they were detected in relatively few of the nine samples obtained.

Based on soil sampling results, the removal of the sand blast area operation, addition of the asphalt parking lot, and new sewage treatment plant buildings, no further action was recommended for this unit under a residential use scenario under CERCLA (U.S. Navy, 1999e).

SWMU 67 - Building 448 Tar Tank Area

The Building 448 Tar Tank Area (formerly known as IR Site 48) was located approximately 120 feet south of Building 448 and 20 feet east of Building 946. This site consisted of two horizontally mounted tanks within a secondary containment structure. These tanks contained a heavy tar substance once used for road repair. Dark stained soils were observed beyond the secondary containment during the Navy Site Visit. This site, which began operation in 1985, is currently inactive. The tanks and secondary containment were removed in August 1993.

During a field investigation conducted in July 1993, ten surface grab samples were collected and field-screened using an immunoassay procedure specific to petroleum hydrocarbons. The objective of the field screening was to collect samples for semi-quantitative contaminant determinations and subsequently to use this information to define the sample locations. Following the field screening analyses for petroleum hydrocarbons, surface soil samples were collected for laboratory analysis. A detailed description of the sample locations, the samples collected, and the rationale for their collection is provided in the SSP Report (Halliburton NUS, 1993b).

Concentrations of various PAH compounds found in the soil around the site exceeded RBCs. In October 1994, soils were excavated (approximately 100 CY) under a removal action and the area was restored to original site conditions. The excavation sidewalls and floor were sampled to confirm that contamination above RBCs had been removed.

In January 1995, the Navy Remedial Project Manager requested that a groundwater sample be obtained from SWMU 67. A groundwater sample was collected from the center of the site using direct push techniques. The sample was analyzed for TCL VOCs, SVOCs, PCBs, and TAL inorganic analytes. Sample results indicated that VOCs, SVOCs, and PCBs were not present. Some metals were present, but none exceeded background concentrations. The borehole was grouted at the completion of sampling.

The results indicate that all but one constituent, benzo(a)pyrene, are below RBCs. Benzo(a)pyrene concentrations at two locations, although they exceeded residential screening criteria based on an incremental cancer risk level of 1×10^{-6}, are well within USEPA's target risk range of 1×10^{-6} to 1×10^{-4}. Average benzo(a)pyrene concentrations are below soil to groundwater screening criteria. Based on the contents of the February 2002 Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA (U.S. Navy, 2002a).

SWMU 70 - Building 152 TRICHLOROETHANE ACCUMULATION AREA

The Building 152 1,1,1-trichloroethane (TCA) Accumulation Area (AA) (SWMU 70) was located adjacent to the eastern side of Building 152, on Mainside. The unit consisted of an approximately 6-foot by 8-foot concrete pad without berms and a hazardous materials locker that measured approximately three feet wide by five feet long by five feet high. A drain to the sanitary sewer was located within the concrete pad.

The Building 152 TCA AA (SWMU 70) has been used since the 1960s for storing hazardous material products and drummed solid wastes contaminated by 1,1,1-TCA, the solvent used to wash oil from the vacuum furnace. The hazardous material stored in the locker includes TCA; approximately one drum is used every three to four months. The solid wastes stored at the unit include one 55-gallon drum each of

TCA-contaminated sludge from the abrasive saw; TCA-contaminated shavings from the blast peen; and TCA-contaminated powder, also from the blast peen.

In June of 1994, operations were modified to move TCA (new and spent) indoors. New TCA is currently stored in a 5-gallon container inside Building 152, and spent TCA is piped directly from the equipment into a 5-gallon satellite AA container also within building 152.

Field investigation activities at the site included collecting a total of four surface soil (0 to 12 inches) samples. These samples were collected just outside the concrete slab. These samples were analyzed for total metals, PCBs, and VOCs. Human Health Risk was evaluated under an industrial use scenario.

Manganese, PCBs, barium, chromium, mercury, and nickel were noted as COCs. Manganese and PCB levels were elevated slightly above the industrial and residential screening levels, respectively; however, these levels do not appear to present a significant risk, under the industrial use scenario. The remaining metals slightly exceeded soil screening levels for the protection of groundwater. However, based on the following: relatively low concentrations of these constituents, existing concrete and asphalt paved surfaces limiting potential infiltration to groundwater, comparisons to site-wide background soil concentrations and the small area of the unit, these constituents are not expected to impact groundwater quality or increase risk to groundwater.

Based on the sampling results, current and planned future use, current storage and handling procedures for hazardous material, and on professional judgment, no further action is required for this unit, under a continued industrial use scenario (U.S. Navy, 1996b).

SWMU 77 - Building 1329 Wash Area

The Building 1329 Wash Area (SWMU 77) was located north of Building 1329 at Mainside. It was a concrete pad that measured approximately 16 feet by 54 feet and was bermed on two sides. The concrete pad was covered by a roof/shelter. The unit drained to an oil/water separator which drained to the Cooling Pond (SWMU 129) on the base.

The Building 1329 Wash Area (SWMU 77) had been used since the 1960s to wash maintenance trucks. Although the washing process now involves steam-cleaning the vehicles using a non-petroleum detergent, petroleum-based detergents may have been used in the past. According to NSF Dahlgren personnel, the concrete wash pad was rebuilt over an old oil/water separator.

An investigation began in March 1996 to delineate the extent of contamination. Contaminated soil from an area between the wash pad and the chain link fence was excavated to an average depth of two feet. Approximately 73 tons of contaminated soil were removed and transported to an approved landfill disposal facility. In April 1996 and May 1996, additional soil borings were taken to assess the release of petroleum under the concrete slab and south of the fence. After contamination was observed under the concrete slab, the investigation was terminated due to funding issues.

An EE/CA was performed for this site and finalized in May 1997. The Removal Action objective was removal of TPH contaminated soil. Upon public comment on the EE/CA, the removal action consisted of excavating approximately 922 CY of TPH-contaminated soil over a 3,600 square foot area, and extending to a depth of approximately seven feet. Contaminated soil was transported to an offsite permitted facility. The abandoned oil/water separator was removed and shipped offsite as construction and demolition debris in July 1997. Confirmatory sampling (26 samples) indicated that removal objectives were met. A final report was submitted in October 1998 (OHM Remediation Services Corp., 1998b).

Based on confirmatory sampling results and considering current and planned future use, the RPMs believe the results indicate that no samples were found to exceed the cleanup level of 100 mg/kg for TPH. Based on the contents of the July 2001 Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA (U.S. Navy, 2001a).

SWMU 78 - Building 1121 Former Waste Oil UST

The Building 1121 Former Waste Oil UST (SWMU 78) was located at the Heavy-Duty Equipment Shop at Mainside. The site consisted of a 1,000-gallon UST outside the shop that received motor oil from a slop sink inside the shop. The site was sampled on November 1991, prior to excavation of the UST. Approximately 200 to 650 CY of contaminated soil were removed from the excavation based on visually evident soil contamination. There were no historical reports of spills, and the tank appeared intact. The release was thought to be from deteriorated fittings and connections from the piping to the UST.

In December 1991, the original 1,000-gallon steel UST and contaminated soil were removed. Clean fill and a double-walled fiberglass tank with a spill alarm replaced the original UST. In 1993, subsurface soil borings were taken which revealed minor amounts of TPH soil contamination.

An EE/CA was performed for this site and finalized in May 1997 (U.S. Navy, 1997a). The RAO was to remove TPH-contaminated soil. Following public comment on the EE/CA, the removal action consisted of excavating approximately 150 CY of TPH-contaminated soil from an excavation of approximately 21 feet by 26 feet extending to a depth of approximately seven feet. Contaminated soil was transported to an offsite permitted facility. Post-excavation samples did not exceed the Virginia Action levels for TPH (100 mg/kg), as set forth by the Virginia Hazardous Waste Management Regulations 9VHWMR 680-13-02, Underground Storage Tank Technical Standards and Corrective Action Requirements, Action Level Guidance. Groundwater levels were also compared with Virginia Action Levels and USEPA's RBC tap water screening values, and none were exceeded. A final report was submitted in October 1998 (OHM Remediation Services Corp., 1998b).

Based upon this sampling data, the conditions of the site, and professional judgment, no further action is required for this unit under a residential use scenario under CERCLA (U.S. Navy, 1999i).

SWMU 82 - Electroplating Line and WWT

The Electroplating Line and Wastewater Treatment (WWT) system (SWMU 82) were inside Building 404 at Mainside. It began operations in the early 1970s and after several inactive periods lasting several months, ceased operation permanently in early 1993.

The Electroplating Line and WWT (SWMU 82) consisted of six components: the epoxy-coated concrete flow-through in the circuit board printing and etching lines; the 2,000 gallon fiberglass holding tank; the CPU, a 200-gallon steel cylindrical device; the 500-gallon, double-shelled plastic holding tank; the four resin filters; and the final 10,000 gallon plastic tank with fiberglass and plastic fittings. The unit was used to treat electroplating waste waters. The used resin filters are considered a hazardous waste. The treated water was recirculated and the sludge was contained in the filters.

The operating components of this unit were in good condition; however, the concrete floor of the holding tank/filter room was stained and cracked.

The underlying site soils were removed in March 2004 and a Site Close-Out Document was completed and signed. Groundwater beneath the site is being investigated in the Site 20 RI/FS. Based on the contents of the Site Close-Out Document, it is the consensus of the RPMs that SWMU 82 requires no further action under a residential use scenario under CERCLA (U.S. Navy, 2001a).

SWMU 101 - Building 155 Auto Shop Waste Oil Filter and UST

The Building 155 Auto Shop Waste Oil Filter and UST (SWMU 101) was located inside Building 155 at Mainside. The building was designed to manage used automobile oil and consists of the following components: three 55-gallon drums of oil on a plastic pallet with secondary containment; a metal slop sink for transferring used oil; a 1,000-gallon double-walled fiberglass, concrete-bottomed UST to which the slop sink drains; an open-topped steel filter; and various steel and plastic buckets. The SWMU has been in use since the 1960s, although the fiberglass UST was installed in the spring of 1992 to replace a steel UST removed in December 1991. The unit is under the supervision of the VDEQ, Office of Water.

SCS Engineers (SCS) was authorized by NSF Dahlgren to prepare a Site Characterization Report in January 1992 for the former Building 155 steel UST after its removal. The report documented field activities during UST removal and subsequent site characterization efforts by SCS. The following paragraphs summarize the information provided in the SCS report (U.S. Navy, 2002c).

In January 1992, two soil samples were obtained by Atlas Resource Management from a depth of ten feet at the bottom of the UST excavation. These samples were analyzed by Technical Testing Laboratories for TPH using USEPA Method 418.1. According to the SCS report, neither sample contained TPH. Free product was not encountered during UST removal or subsequent site assessment (U.S. Navy, 2002c).

In June 1992, Steven’s Drilling, Inc. advanced two soil borings with oversight by SCS. Soil samples were obtained at five-foot intervals using split-spoon samplers and screened for total organic vapors with a photo-ionization detector (PID). Organic vapor concentrations were all below three ppm. Borings B1 and B2 were completed as MW-1 and MW-2, respectively (U.S. Navy, 2002c).

SCS Analytical Laboratory submitted soil samples from the interval exhibiting the highest PID reading for TPH analysis. TPH was not detected in the sample from B-1, obtained from a depth between 14.5 and 16.0 feet (sample ID “155 B1” in the laboratory report). TPH was present at a concentration of 33 mg/kg in the sample from B-2, obtained from a depth between 4.5 and 6.0 feet (sample ID “155 B2” in the laboratory report). Concentrations were below the TPH action level of 100 mg/kg (U.S. Navy, 2002c).

Groundwater samples were obtained from the three monitoring wells by SCS in June and July 1992. The SCS Analytical Laboratory analyzed the samples for TPH in accordance with USEPA Method 418.1 and for aromatic VOCs in accordance with USEPA Method 8020. Based on the groundwater elevation contours, MW-2 is downgradient of the UST. Samples from MW-1 and MW-2, collected in June, contained TPH at concentrations of 18.1 mg/L and 0.5 mg/L, respectively. VOCs were not present in the groundwater samples. VOCs and TPH were not present in the sample obtained from the existing monitoring well, collected in July 1992 (U.S. Navy, 2002c).

The SCS report concluded that no additional action was necessary. The UST and adjacent soils were removed, and the remaining soils contained TPH below action levels. Although the one mg/L action level for TPH in groundwater was exceeded in one monitoring well, aromatic compounds typically associated with petroleum products were not present (U.S. Navy, 2002c).

In 1996, SWMU 101 was among several Appendix B sites sampled by Martel. Martel obtained groundwater samples from what appears to be MW-2 and the monitoring well that existed prior to SCS field efforts. These samples were analyzed for metals, VOCs, TPH, pesticides, and PCBs. In addition, Martel obtained soil and water samples from a boring twelve feet south of the UST using Hydropunch techniques. Both soil samples and the water sample were analyzed for VOCs and VOCs were not present above detection limits. Sample SWMU 101 SS 2' – 4' and the water sample were also analyzed for TPH, pesticides, and PCBs. Pesticides and PCBs were not detected; TPH was present at a concentration of 150 mg/kg in the soil sample, slightly above the TPH action level of 100 mg/kg. The water sample contained TPH at a concentration of 1.1 mg/L. All samples were analyzed for metals. Soil sample results were compared to RBCs and background levels. Water sample results for metals were not considered since the sample was obtained using hydropunch techniques which typically yield highly turbid samples and false positives for elevated metals (U.S. Navy, 2002c).

Based on sampling results and considering current and planned future use, the RPMs believe the existing data is adequate to estimate risk at this site. All constituent concentrations are below background and below RBCs. All constituents detected in the groundwater obtained from the downgradient monitoring well were below Region III tap water PRGs and MCLs. Based on the contents of the April 2002 Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA (U.S. Navy, 2002c).

SWMU 115 - Building 1282 Auto Hobby Outside Used Oil Storage

The Building 1282 Auto Hobby Outside Used Oil Storage (SWMU 115) is located outside the Auto Hobby Shop (Building 1282), on the eastern part of Mainside. It consists of 4 foot by 4 foot square steel pallets. The storage area was relocated inside Building 1282 in August 1992. The area outside the building, where the SWMU was located prior to August 1992, is currently vegetated with grass.

The Building 1282 Auto Hobby Outside Used Oil Storage (SWMU 115) has been used for storage of used automobile oil and antifreeze (ethylene glycol) since the mid-1980s, when a vehicle fuel filling station was built in front of Building 1282's current location. The unit is under the supervision of the VDEQ, Office of Water.

In September 2003, a Site Close-out Document was completed and signed. All soils underlying the SWMU have been removed and the storage area was relocated inside of Building 1282. Based on the contents of the Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA.

SWMU 119 - Building 1282 Auto Hobby Used Oil Tank

The Building 1282 Auto Hobby Used Oil Tank (SWMU 119) is located south of the Woodworking Shop at the eastern part of Mainside. The aboveground steel tank has approximately 1,000 gallons of capacity and has been used since 1992 to store used motor oil. The unit is equipped with secondary containment, in the form of a concrete dike. The walls of the dike are approximately three feet high and six inches wide. In August 1992, a shelter was built to prevent precipitation from entering the secondary containment basin around the tank (U.S. Navy, 2004).

Maximum concentrations of chemicals detected in the soil and groundwater samples collected form SWMU 119 and Building 1282 were compared to RBC Table screening levels for industrial and residential use scenarios, and to soil screening levels for the protection of groundwater. Risk was evaluated under the residential and industrial use scenarios. The groundwater analytical data were compared to USEPA Region III tap water RBCs and MCLs.

The comparisons with screening criteria show that all constituents are below RBCs and/or well within USEPA's target risk range of 1×10^{-4} and 1×10^{-6}. Based on the contents of the Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA (U.S. Navy, 2004).

SWMU 125/Site 52 - OWS 107-350 (Yardcraft Area)

The Site 52 Yardcraft Area is located at the southern edge of the Mainside, bordering Upper Machodoc Creek. Previously, the site consisted of Building 107, which was a boat engine repair and maintenance shop, an OWS, a bermed concrete pad with a roof canopy used to store new and used oil in 55-gallon drums, and an UST. Chemicals used in the engine repair shop included degreasers, oils, and various fuels. Building 107 and the associated bermed pad, the OWS and UST were demolished and removed from the site in late 2003 and early 2004.

The wash rack, located adjacent to the engine shop, consisted of a bermed concrete pad with a drain in the center. This pad was used as a discharge location for bilge water from ships and was used to store drums of oil. The drain in the wash rack was piped to the OWS for treatment prior to discharge to the facility's sanitary sewer system. The OWS was located off the northeast corner of Building 107. In addition, the steel 350-gallon approximate capacity UST, was located adjacent to the southeastern corner of Building 107 and was used to supply #2 heating oil to the building. This UST was installed in the early 1990s, replacing a similar tank. The unit has been used since the late 1980s or early 1990s to separate oil from bilge water. Water that passes through the in-ground OWS flows to a lift station, which leads to the sanitary sewer.

Approximately 550 tons of soil was removed from the excavations at Site 52 in May 2004 and transported to a RCRA Subtitle D Facility. Verification samples were taken to confirm that the area is remediated. A VSAP was submitted in August 2004 and served to close out the site. Based on the VSAP results, it is the consensus of the DIRT that the site requires no further action under a residential scenario under CERCLA and SWMU 125/Site 52 was closed out.

SWMU 127 - OWS 1121-300, OWS 115-350, OWS 402-30,000, and OWS 486-1000

These OWSs are located west of Building 1121. They received wastewater that probably contained oil and grease from vehicle wash and maintenance operations, oil storage, storage operations, and parking lot run-off. The OWSs began operation at different times and are constructed of 1-inch baffled steel.

OWS 1121-300 has 300 gallons of capacity and discharges to OWS 115-350. OWS 115-350 has 350 gallons of capacity and discharges to a lift station, which in turn discharges to the sanitary sewer. OWS 402-1000 has 30,000 gallons of capacity and discharged to the Cooling Pond (SWMU 129). OWS 486-1000 has 1,000 gallons of capacity and also discharged to the Cooling Pond.

Six subsurface soil samples and two groundwater samples were analyzed for TCL VOCs, SVOCs, TAL metals, and hexavalent chromium. There were only a few exceedances of screening criteria and none of them were significant. No further action, under a CERCLA residential use scenario, has been recommended during the May 2005 DIRT meeting and SWMU 127 was closed out.

SWMU 128/Site 54 - OWS 1121-Old

The OWS 1121-Old (known as USEPA SWMU 128) was located south of Building 1121, the Heavy Duty Shop, at the opposite corner of the building from the new OWS 1121. The OWS 1121-Old operated from the 1960s until about 1989.

It was constructed of baffled steel and concrete and had an unknown capacity. The OWS received liquids that likely contained oil and grease washed from the floors of Building 1121, where heavy machinery maintenance was done. The line to the old OWS 1121 has been plugged. Soil samples taken just west of the site did not exceed USEPA Region III Industrial Soil Screening values for volatiles, semi-volatiles, metals and TPH. Since this OWS was no longer needed, and could provide a conduit for future contamination of soils, it was targeted for removal along with the SWMU 78 contaminated soils.

An EE/CA was performed for this site and finalized in May 1997 (U.S. Navy 1997a). The RAO included removal of potential TPH-contaminated soil and removal of the abandoned oil/water separator. Following public comment on the EE/CA, the removal action consisted of excavating approximately 150 CY of TPH-contaminated soil from an approximate area of 19 by 30 feet, and extending to a depth of approximately seven feet. Contaminated soil was transported to an offsite permitted facility. The abandoned oil/water separator was removed and shipped offsite as construction and demolition debris. Confirmatory sampling indicated the removal objectives were met. A final report was submitted in October 1998 (OHM Remediation Services Corp., 1998).

The Close-Out Document for SWMU 128 - Site 54 was completed in September 2006. The conclusions of the Close-Out Document state that while metals were detected in the subsurface soil samples taken from the site, only four metals (aluminum, arsenic, iron and vanadium) exceeded the USEPA screening criteria, however since their reference doses are based on average daily intake values and not on adverse health effects, their exceedances are not of concern. Since the arsenic result is within the USEPA's target risk range of 10^{-6} to 10^{-4}, the remaining soil does not present a concern. The maximum vanadium concentration of 21 mg/kg has an estimated residential hazard quotient (HQ) of 0.27, which is less than the acceptable HQ criteria of 1.

The groundwater comparisons show that all detected VOCs were below screening criteria. Only one metal, manganese, was detected but its concentration was less than the USEPA Region III screening criteria for tap water. TPH, while detected at concentrations above the target action level of 100 mg/kg during pre-RA sampling, was less than 100 mg/kg during post-removal sampling.

Improved operation and maintenance activities associated with OWSs, as well as monitoring of the condition of the tanks, have further minimized any potential impacts SWMU 128 might have on the environment. Therefore, it is the consensus of the RPMs that Site 54 requires no further action under a residential use scenario under CERCLA.

SWMU 130/Site 28 - Yardcraft Oil Storage Area

The Yardcraft Oil Storage Area (SWMU 130) is in the Yardcraft Area behind Building 288, approximately 25 feet east of OWS 107-350 and approximately 50 feet from Upper Machodoc Creek at Mainside. The unit has been in use since the late 1980s or early 1990s.

The Yardcraft Oil Storage Area (SWMU 130) consists of a four-sided concrete pad with storage racks for up to five 55-gallon drums. The pad is approximately six feet by six feet and the berms are approximately one foot high. The pad is sloped toward a drainpipe in the berm at the side nearest Upper Machodoc Creek. The drainpipe allows liquids inside the bermed pad to drain onto the asphalt lot, and the pad is slightly uphill from Upper Machodoc Creek.

Stains were visible around the pad near the drainpipe during the Navy Site Visit, and a strong oil-like odor was noted. At that time, four 55-gallon steel drums of oil product were being stored on their sides in the storage racks on the pad.

The facility is upgrading this area in response to the National Pollutant Discharge Elimination System (NPDES) permit for industrial discharge. Stained soil was removed in response to the VPDES permit modification.

Maximum concentrations of chemicals from soil sampling were compared to RBC Tables, to screening levels for industrial and residential use scenarios, and to soil screening levels for the protection of groundwater.

Through comparison of maximum site concentration data to USEPA Region III screening criteria for COCs, it was determined that although arsenic exceeded the screening criteria, background comparisons indicated that it could be naturally occurring. Barium slightly exceeded the SSL for soils to groundwater, but was within base background concentrations. Nickel exceeded the SSL for soils to groundwater and the range of background, but was not considered site-related and was within residential screening criteria. Based on this information, further metals analysis was not performed for the Post-Excavation analysis.

Confirmation sampling in March 1996 consisted of two soil borings and one groundwater sample. No positive for TPH, SVOCs, or PCBs results were reported for soil and groundwater samples.

Based on sampling results and the removal of petroleum contaminated soil with the corresponding asphalt paved area, the RPMs recommended no further action under the residential use scenario under CERCLA (U.S. Navy, 1999f).

SWMU 131/Site 28 - Gambo Creek Compost Area

The Gambo Creek Compost Area (known as USEPA SWMU 131) is located west of Gambo Creek, near Building 1369 at Mainside. It consists of one mound over an approximate 2 acre area. The mound is approximately 50 feet in diameter and 12 feet high.

From the 1950s until the 1960s, wood chips, mulch, sawdust, leaves, trees, and similar materials were dumped on the ground where they eventually formed a mound. The mound is heavily vegetated.

Fourteen soil samples were analyzed for TCL VOCs, SVOCs, TAL metals, pesticides/PCBs, and hexavalent chromium. There were few exceedances of screening criteria and none of them were significant. No further action, under a residential use scenario under CERCLA, was recommended during the May 2005 DIRT meeting and SWMU 131 was closed out.

AOC A - Otto Fuel Spill (IAS Site 33)

Otto Fuel Spill (AOC A) is located in the Harris Range in the EEA. The AOC consists of one section of bare soil where Otto fuel, a highly toxic, carcinogenic liquid propellant for torpedoes reportedly was spilled directly onto the soil in the 1970s. The one-time spill of approximately 13 gallons is roughly estimated to have covered an area of approximately 15-foot by 8-foot. File materials indicate that soil was cleaned by saturating it with petroleum products which were then ignited. In addition, facility representatives indicated that one area was covered with sand.

The area is located in an active range. Using sprayed herbicides to minimize the potential for uncontrolled fires intentionally destroys vegetation. Thus, the ground in the Otto Fuel Spill area and the surrounding area consists of soil and gravel that are free of vegetation.

No sampling for Otto fuel was performed at this site. Otto fuel consists of propylene glycol dinitrate, 2-nitrodiphenylamine and di-n-butyl sebacate.

Based on the following information: 13 gallons of Otto Fuel spilled onto the ground seventeen years ago (over time Otto fuel will degrade), EOD responded to the spill by burning the contaminated area with diesel fuel, and the resulting breakdown products of Otto fuel do not present substantial risk to human health. After evaluating the foregoing information, the RPMs believe that this AOC does not represent a human health or environmental risk, therefore, no further action is required at this AOC (U.S. Navy, 1996c).

AOC O - Building 1369 Pesticide Spill Area

The Building 1369 Pesticide Spill Area (AOC O) is located south of Building 1369. The lack of vegetation was caused by a one-time leak from a pesticide sprayer during spring 1992. This area is approximately 8 feet by 15 feet. Runoff from this area drains to an unlined drainage ditch located approximately four feet to the west.

During spring 1993, an optic line was installed for the operations in Building 1369. As part of the installation of the optic line, this area was excavated, soil removed, and the area reseeded with grass. West of the drainage ditch is a wooded area with pine trees; the general area often is covered with yellow pine pollen.

Field investigation activities at the site included collecting a total of six surface soil (0 to 12inches) samples. These samples were analyzed for total metals, TPH, PCBs, and pesticide analysis.

PCBs and pesticides were not detected at levels above the instrument detection limit. Aluminum and manganese were detected at levels above screening levels; however, they were all within background levels for the facility. Iron levels exceeded the USEPA RBC screening and background levels; however, the overall concentrations do not appear to be significantly elevated.

Arsenic levels exceeded the RBC value and were above background levels; however, the arsenic levels were not found at levels to cause unreasonable risk. The estimated risk from the potential exposure to arsenic is well within the acceptable risk range. Selenium and barium were detected at levels above the soil screening levels for protection of groundwater but these constituents do not appear to be connected to the pesticide contamination; they are more likely associated with background soil conditions. Metals concentrations do not appear to be present at levels presenting a risk to human health or the environment.

Based on sampling results, the RPMs believe the existing data is adequate to estimate risk at this site. The few COCs which are elevated slightly above screening (RBC/SSL) values are not expected to present a significant risk for a residential use scenario. Based on the contents of the Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a future residential use scenario (U.S. Navy, 1996d).

AOC X - Classified Documents Incinerator Sewage Holding Tank (IAS Site 18)

The Classified Documents Incinerator Sewage Holding Tank (AOC X) is south of Building 1350. The area consisted of one 30 foot diameter by 6 foot deep holding pond, one concrete solids holding tank, one concrete pump pit, and one 100 foot by 100 foot infiltration field, approximately 70 feet to the east of the pond and connected to it by a piping network. This system served as a sewage holding and dispersion system for the sanitary facilities at the Classified Incinerator building. The Classified Documents Incinerator Sewage Holding Tank was in operation from 1974 to 1989. The ground surface area at AOC X is generally level with the exception of the pond, which is in an approximately six-foot deep depression.

Surface soil, subsurface soil, and groundwater samples were collected during an investigation conducted at AOC X in September 1994. Based on elevated levels of mercury discovered in one sample, the tanks and the soils within the pond area were excavated and disposed of in a permitted landfill. In addition, a one-foot thick surficial layer of soil was removed from the 30-foot diameter bottom of the holding tank. Both the concrete solids holding tank and the concrete pump pit were removed along with all of the metal piping. The area was backfilled with clean soil, regraded, and reseeded. Confirmation samples were collected after the cleanup was completed. Using results from the confirmation samples, maximum concentrations of potential COCs were compared with RBC values as of April 2000. All COCs that exceeded any risk-based criteria were below background, except for arsenic and iron. Both arsenic and iron concentrations were comparable to background.

Based on the confirmation samples and the Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action at this time, under a residential use scenario under CERCLA (U.S. Navy, 2000e).

AOC X7/Site 39 - Open Storage Area Main Battery (Staining)

The Open Storage Area Main Battery (known as USEPA Additional Area X7) was in the southeastern portion of Mainside. It was discovered by USEPA after an analysis of aerial photography of the NSF Dahlgren. The following description is from the USEPA VSI Report. The unit was used for open storage as early as 1953, and objects were arranged in rows and along the railroad. A stain in the southwest end of the open storage area was visible in the 1967 photograph. Additionally, a drain that directed flow to the railroad from the storage area was identified. A second stain was identified along the drain channel running along the railroad in the 1985 image. Cleaning solvents were used in this area to remove preservatives from gun barrels. Cutting and welding of metals was also performed in the open storage area.

During USEPA's August 1992 VSI, several areas of staining were identified around the west side of the open area and the drain. The open area is presently used to store three double rows of gun barrels. There were also two areas in the open storage area that contained collection drains for runoff and storm sewer control. There was one area near one of these drains where welding slag was identified.

Field investigation activities at the site included collecting a total of ten surface soil (0 to 12 inches) samples within the open storage area. These samples were analyzed for inorganics, PCBs, pesticides, herbicides, TPH, and TCL VOCs. The investigation activities did not include groundwater samples. Risk was evaluated under both residential and industrial use scenarios, based upon the soil sampling results. A cleanup was identified and performed in March 1996. The cleanup included the removal of accumulated sediments and sludge at and around each of the two storm drain catch basins. Approximately one-half ton of sediment and sludge were removed from the site and disposed at a permitted facility.

Maximum concentrations of chemicals from soil sampling were compared to RBC Tables, to screening levels for industrial and residential use scenarios, and to soil screening levels for the protection of groundwater.

Risk was evaluated under the residential and industrial use scenarios, based upon initial sampling results. Based upon inorganic, TPH, and one VOC exceedance, a cleanup action was identified and performed in March 1996. Accumulated sediment and sludge were removed from the area surrounding each of the two catch basins, #1 and #2. Approximately one-half ton of sediment and sludge was removed from the catch basins and the asphalt surface storage area and disposed offsite at a permitted facility.

Based upon the source removal and modifications to the operations of the site, no further action is required for this unit under a continued industrial use scenario under CERCLA (U.S. Navy, 1999c).

AOC Z - Terminal Range Building 109

The Terminal Range Building 109 (AOC Z) was located in the Terminal Range area at Mainside. This unit operated from approximately 1949 to 1985 as a research and development unit and a fuse chamber for testing projectile fuses. This unit was an open-topped, below-grade structure approximately 25 feet by 15 feet and 20 feet deep. The walls were constructed of two-foot thick concrete with steel armor plate (5.5 inches thick) in front for protection from projectiles. The walls originally extended from four feet above grade to 20 feet below grade. The walls formed a square that enclosed an area known as "the pit."

The unit was removed and all the steel plates sold to a private vendor for scrap in July 1993. The bottom of the pit was in the groundwater table; therefore, during periods of high rainfall the pit had water in it. Site cleanup was completed in October 2001. Soil/slag and debris were disposed offsite in a Subtitle D landfill, and 12,000 pounds of slag and soil were disposed as hazardous waste (lead) at Perma-Fix of Michigan. Once the removal was complete, the site (i.e., the pit) was backfilled with clean fill mixed with compost from Site 41 and graded to a relatively flat area.

Based on the contents of the Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario (U.S. Navy, 2002e).

Other Units C3 - Scar at Phalanx Test Area

The Scar at Phalanx Test Area (Other Units C3) is located west and north of the Phalanx Test Area and west of the Potomac River. It is a former rocket launch area that operated from the 1960s to the 1970s, is grass-covered, and about five acres in size. The rockets launched include the 2.75 rocket and Zuni rockets. The launches were conducted on the ground after the area had been cleared of grass.

Environmental sampling of soil at the site at Phalanx Test Area occurred in July 1994. No unusual metals concentrations or distributions were observed. With respect to the other analytes, no VOCs, PCBs, herbicides, and TPH were detected above quantization limits. MCPA, chlorinated herbicide, was the one constituent that exceeded residential and industrial screening. However, it was found in only one sample out of nine and is not site-related.

This site has not been in use since the 1970s. Based on the contents of a 2003 Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario.

Other Units C6 - Former Radio Testing Area

The Former Radio Testing Area (Other Units C6) is located in the north central portion of Mainside. This unit was discovered by USEPA after an analysis of aerial photography of the . The following description is from the USEPA VSI Report. Two trailers were located south of Frontage Road near the 1400 Area Landfill (SWMU 30). These trailers were used to test radar or microwave radio equipment. The area, as identified by aerial photography, had two drains or ditches leading from the trailers to the small tributaries leading to Hideaway Pond (AOC N).

EOD personnel performed a magnetometer sweep of the area formerly used for radio/radar testing to identify any remaining underground tanks or piping. No underground tanks or piping were found. When the site was converted into a parking lot, construction debris and two drainpipes were removed in 2002. The underlying soil was sampled for metals, cyanide, volatile organic compounds, semi-volatile organics, phenols, pesticides, and PCBs. The analytical results showed that no constituents in soil were above background or RBCs. Although lead and chromium in water exceeded some criteria, debris and the drainage lines at the site have been removed and the area is now a parking lot, which further limits exposure to any residual contaminants which may be in the soil. Based on analytical results, no further action under a CERCLA residential use scenario, was recommended to and accepted by the DIRT in May 2004 and Other Units C6 is closed.

Additional Areas X6 - South Hangar Former Tank Area

The South Hangar Former Tank Area (Additional Areas X6) is located in the west-central portion of Mainside. This unit was discovered by USEPA after an analysis of aerial photography of the NSF Dahlgren. The following description is from the USEPA VSI Report. During USEPA's review of aerial photography of an area west of the South Hangar, several stained zones were detected. In a 1983 image, a horizontal tank was identified and a stain detected adjacent to it. A drainage channel was identified from the tank leading to the southwest. In 1985, the tank was gone but the drainage stain remained. This area has a new building and a new paved parking lot in the stained area.

Between 1986 and 1990, a building was constructed at the former location of the tank. In the 1990 image, a new stain was detected slightly to the east of the former stain area. In addition, several stains have been identified to the east of the hangar over the years, but most of these appear to have occurred on the concrete parking lot.

The site was subsequently closed under the September 1994 Federal Facility Agreement, per Section VI, Findings of Fact.

SITE 59 - Octagon Pad Dump, EEA

The Octagon Pad Dump (known as Site 59 or SWMU 135) was located within the Harris Test Range of the EEA at the end of a paved road adjacent to the east side of the Octagon Bombing Pad. The site was active from the 1940s until the early 1990s. Operations at the site consisted of a scrap metal AA , where used metal target and ordnance test items were collected and stored until proper disposal was arranged. Most items were located along the road shoulders, with lesser amounts located on the paved area and beyond the road into the adjacent wooded area. The site size was less than one-half acre.

In January 2001, NSF Dahlgren was tasked to conduct a cleanup of Site 59, which consisted of removing all of the scrap metal, including ordnance and target related scrap. Additional items were removed, including 27 tons of concrete debris. Several earth mounds were screened for MEC and leveled to remove any scrap or waste items. Waste items removed and disposed of through the ’s hazardous waste division included electrical wire, metal banding material, plastic film, and water piping with asbestos wrap.

In 2001, the Site 59 VSAP was approved and implemented at the site. Confirmation sampling, conducted in March 2001, indicated no further action was required at Site 59 based on risk. A stratified random sampling pattern was used for verification sampling. The site was divided into two exposure areas, each approximately one-half acre in size and consisting of six sampling areas (SAs) approximately one-twelfth acre (0.083 acre) in size. One composite sample of six randomly selected grab sample points was collected from each SA. EA West included SAs 1, 2, 3, 5, 6, and 7, and EA East included SAs 3, 4, 7, 8, 9, and 10. SAs 3 and 7 were common to both EAs (U.S. Navy, 2002b).

In addition to the composite samples collected from the Octagon Pad Dump, two discrete samples were collected from a small drainage course located southeast of Site 59. One sample was collected upgradient (or south) of Site 59 and the other was downgradient (or northeast) of the Site. The samples were evaluated as soil samples (rather than sediment) because the watercourse is typically dry (U.S. Navy, 2002b). Laboratory analytical parameters were selected based on previous land use and were approved by the DIRT. Soils were analyzed for TAL metals and cyanide and explosives (U.S. Navy, 2002b).

Laboratory results were presented in a Verification Sampling Report prepared by TtNUS in January 2002. Because the residual soils were at or near the ground surface, verification sample results were compared to surface soil criteria. Site closure was recommended due to low contaminant concentrations (U.S. Navy, 2002b).

Based on current and planned future site use, constituent concentrations which are below residential RBCs and/or background levels, and the contents of the April 2002 Site Close-Out Document, it is the consensus of the RPMs that this site requires no further action under a residential use scenario under CERCLA (U.S. Navy, 2002b).

Building 126 - Former Powder Magazine

Building 126 is a former powder magazine located near Site 6 and Gambo Creek at Mainside. Lightening struck the powder magazine on July 12, 1985 and the resulting explosion threw metal powder and cardboard cans from the magazine into the area surrounding the building. Approximately 120,000 pounds of gun propellant were stored in the magazine. Aerial photographs of the building after the lightening strike showed that an area of one-quarter-mile surrounding the magazine was burned. The building was removed and visible contamination cleaned up.

Eighteen soil samples and seven sediment samples were analyzed for TAL metals, explosives, perchlorate, and asbestos. Only arsenic exceeded the screening criteria, but not significantly. Based on analytical results, no further action under a residential use scenario under CERCLA was recommended during the May 2005 DIRT meeting and Building 126 was closed out.

Site 61b - Gambo Creek Projectile Disposal Area

Site 61b is located on the southern side of the lower Gambo Creek Bridge at Mainside. The site is composed of a pile of gun projectiles of various sizes (3 to 8 inches in diameter), small pieces of scrap metal, and sand. The projectiles appear to have been fired from a gun or used for ordnance testing operations. The buried projectiles appear to be consistent with waste material from old range gun butts. The gun projectiles are located in a wooded area approximately 50 feet from the shoreline of Gambo Creek. The approximate timeframe for the placement of projectiles and potential fill operations is the late 1930s to early 1940s.

A SSP field investigation at Site 61b was conducted between September 2001 and October 2001 and included the following activities (CH_2M Hill, 2001a):

- Geophysical survey
- Surface soil and subsurface soil sampling

- Surface water and sediment sampling

The geophysical survey conducted at Site 61b used both magnetic and EM surveys to help determine the location of buried waste and the boundaries of the site. The SSP field investigation results indicated the presence of inorganics, VOCs, SVOCs, and pesticides in the surface soil, subsurface soil, surface water, and sediment at Site 61b. Of these detections, four SVOCs and five inorganics were retained as COPCs in surface soil and subsurface soil. No constituents were retained as COPCs in the surface water or sediment during the human health risk screening characterization. The ecological risk assessment indicated a potential risk from PAHs with a limited number of inorganic chemicals in the surface soil. In addition, a potential risk to mammalian soil invertebrate predators from exposure (primarily via the food web) to arsenic and copper in Site 61b surface soil was identified.

In addition to the analytical sampling performed at Site 61b, a geophysical investigation was conducted to delineate other waste debris present at the site. The Final SSP report recommended confirmatory trenching and collecting additional groundwater and soil samples from the trenches (CH_2M Hill, 2002). Confirmatory trenching was conducted in March 2003, and the results were summarized in a June 2003 Technical Memorandum. The document concluded that the goals of the investigation were met:

- With the exception of test pit (TP) TP6 where waste was not encountered, the vertical extent of waste was found to vary from approximately 2 to 4 feet bgs. Waste consisted of small amounts of nails, fragments, nose cones, and miscellaneous metal debris.

- Analytical results of the test pit soil and water samples indicated that metals are more prevalent in these media than the other groups of parameters analyzed. Detections of pesticides, PCBs, and SVOCs were infrequent. Explosives were not detected in any of the samples.

Perchlorate analysis was performed on the groundwater sample collected during the excavation conducted in 2003 at Site 61b. Using a detection limit of 1 µg/l, no perchlorate was reported for the sample.

A cleanup action was completed at Site 61b in December 2004. The items removed from the site included:

- 366 tons of contaminated soil
- 1,810 pounds scrap metal
- 1,100 pounds ordnance related scrap

Clean fill from the Turkey Trot Borrow Area was used to restore the site area to its original ground surface elevation, followed by grading and reseeding. A Close-Out document was prepared, which recommended no further action under the residential use scenario, and was signed by the DIRT in February 2005 (JMWA, 2005b).

Building 198 - Neutralization Tank

Building 198 is located near the southern boundary of NSF Dahlgren, just north of Site 37. The neutralization tank is located southwest of Building 198 and is adjacent to the southeast corner of Building 462. The neutralization tank is an approximately 500-gallon underground storage tank that was installed in Building 198 in 1966. According to a historical diagram provided by NSF Dahlgren, the tank is constructed of concrete and may contain a metal lining. The primary function of the tank was to neutralize acid waste discharged from a physics laboratory that was housed within building 198. The types of wastes reportedly discharged to the tank included polymers, solvents, acids, heavy metals, and potentially explosive residue. Use of the tank was discontinued in the late 1970s to early 1980s. Since that time, it was reported that the tank contains water, which may be leaching into it from storm sewers, or surface runoff.

Sampling of the tank was conducted in January 2006 to assess the materials present both inside the tank and in the soils adjacent to the tank. Only two constituents, arsenic and iron, were detected in the soil sample at levels exceeding residential soil RBCs. However, the detected concentrations only slightly exceed the arsenic and iron concentrations detected in background samples. Several non-naturally occurring constituents, including acetone, BEHP, and nitrobenzene were detected in the water sample collected from inside the tank and in the adjacent soil samples. Although these constituents did not exceed residential soil RBCs, their presence in the subsurface soil suggests they are a result of a release from the nearby neutralization tank.

The results of this investigation suggest the following conclusions:

- Residual contamination, likely related to historical use, is present inside the building 198 neutralization tank and the detected contaminant concentrations exceed regulatory comparison criteria.

- Releases from the tank have occurred, but it is unclear if detections in the adjacent soil are from past use (leaks, overflow etc.) or are a result of ongoing storm water infiltration and / or leakage from the tank.

- Subsurface soils in the vicinity of the tank may have been affected by the tank contents, as indicated by contaminant detections in the soil that are similar in nature to contaminant detections inside the tank.

These conclusions will be used by the DIRT to assess the magnitude of environmental impacts in the area of the tank that may warrant further investigation, and to evaluate potential future removal and/or remedial options for the neutralization tank and surrounding soil.

4.0 FACILITY-WIDE ACTIVITIES

This section summarizes the following activities that affect multiple sites within both the Appendix A and Appendix B categories:

- Gambo Creek Ecological Assessment
- Community Involvement Plan
- Perchlorate Decision Making

4.1 GAMBO CREEK ECOLOGICAL ASSESSMENT

Sampling for the initial (Phase I) Gambo Creek Ecological Assessment (EA) was performed in the fall of 1995 for surface water, sediment, and fish tissue. The results of sediment toxicity testing and macroinvertebrate community analysis in the mainstream of Gambo Creek did not indicate obvious effects. Rather, a gradient of potential effects was seen, with some correspondence among the toxicity test results, macroinvertebrate data, and sediment chemistry. PCBs in mummichog tissue were above a conservative screening level at most Gambo Creek locations. Based on the results of the Phase I study, additional sampling of sediment and fish was recommended.

Phase II of the Gambo Creek EA was completed in September 2003. Conclusions and recommendations of the Phase II EA included:

- In areas where high contaminant concentrations were detected in sediment near Sites 6 and 46, sources should be controlled. These contaminated sediments were potentially serving as secondary sources and potentially increasing the area of risk for benthic invertebrates. Remediation of large areas of marsh should be approached with caution; the most important issue is to significantly reduce secondary source areas. Since the collection of the Gambo Creek Phase II EA data in 2000, remediation of both Sites 6 and 46 has been addressed in a ROD. Remediation of Site 46 was completed in the fall of 2002. Remediation of Site 6 was completed in 2004.

- Monuron and mercury posed negligible risk to ecological receptors and were not retained as final COCs. The following chemicals did not pose risk in the tidal portion of Gambo Creek, but remained as sediment COCs for particular sites, due primarily to areas in which the extent of contamination had not been delineated: total DDT, total PCB, barium, beryllium, cadmium, cobalt, manganese, selenium, and silver. Decisions, including potential future remedial efforts to address contamination associated with sites in the Gambo Creek system, should consider that the nine COCs listed pose relatively low risk and/or tend to co-occur where concentrations of COCs with better known toxicity are elevated.

Based on recommendations provided in the Phase II Gambo Creek EA, supplemental sediment sampling was performed in Gambo Creek in October 2006. The objective of the supplemental sediment sampling was to increase the understanding of the spatial distribution of contamination within the Gambo Creek basin. To address spatial gaps between existing sample locations, fourteen sediment samples were collected from four areas: Upper Gambo Creek, Middle Gambo Creek, Lower Gambo Creek, and the Unnamed Tributary North of Site 62. Analyses of the sediment samples included: PAHs, SVOCs, Pesticides/PCBs and metals.

Results of the supplemental sediment sampling and analyses indicated the following:

- Detected contaminant concentrations were consistent with those found in the 2003 Gambo Creek Phase II EA.
- The additional data provided a better spatial definition of previously identified areas of contamination in Gambo Creek and its tributaries.
- The data did not indicate the presence of additional sources.
- Remedial actions undertaken at IR Sites at and along Gambo Creek have been effective in mitigating contaminant migration.

Based upon these results, the objective of better characterizing sediment contamination within the Gambo Creek system has been addressed. The results of the supplemental sampling were documented in a final Technical Memorandum (TtNUS, 2008). The DIRT is currently discussing how to address remaining BTAG concerns with respect to Gambo Creek, and how best to address closeout of the Gambo Creek Assessment.

4.2 COMMUNITY INVOLVEMENT PLAN

The Community Involvement Plan was updated in January 2004. Information collected during the community interviews and the review of local newspapers, other general information, the 1995

Community Relations Plan, and Federal regulations and guidelines were evaluated to determine the most appropriate mechanisms to disseminate information about the NSF Dahlgren. Ninety-six interviews were conducted from six counties, including King George, Caroline, Westmoreland, and Northumberland counties in Virginia and St. Mary's County in Maryland.

4.3 PERCHLORATE DECISION MAKING

Due to the nature of waste materials disposed of at the NSF Dahlgren, perchlorate analysis has become increasingly more prevalent. In order to implement a consistent approach to collecting and analyzing samples for perchlorate in groundwater, a flow chart, which shows the various decisions to determine whether a site should be sampled for perchlorate, was developed by the DIRT and is shown in Figure 4-1. In addition, the decisions made to determine the need for perchlorate sampling, the locations sampled, and their results are shown in Table 4-1. DOD has recommended EPA method 314.0 as the preferred analytical method for perchlorate analysis for water samples. DOD has also adopted the latest cleanup criteria of 24 µg/L for water, which was recommended by the National Academy of Sciences.

Figure 4-1
PERCHLORATE DECISION TREE FOR GROUNDWATER

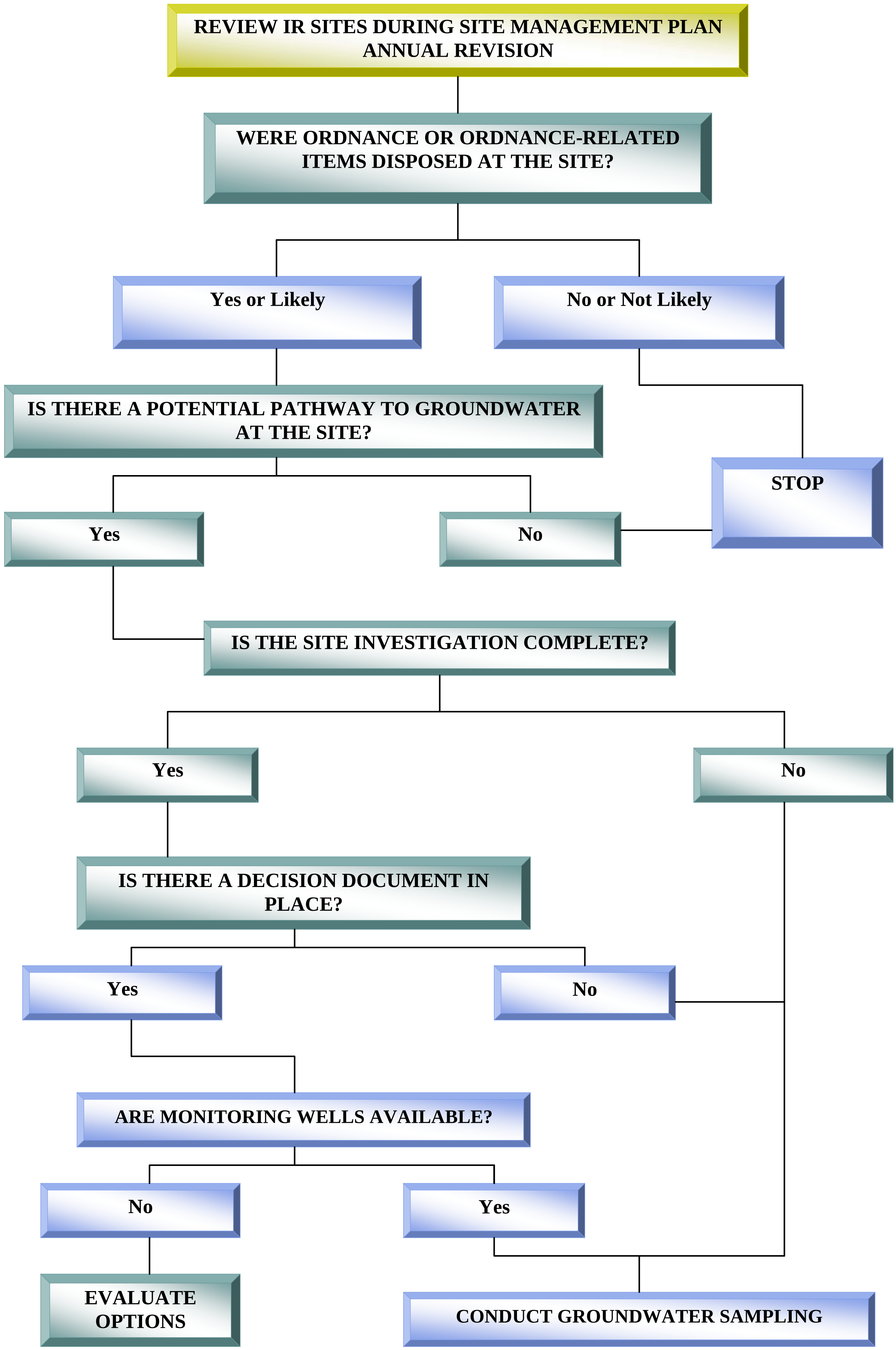


TABLE 4-1
PERCHLORATE GROUNDWATER RESULTS
APPENDIX A
NAVAL SUPPORT FACILITY DAHLGREN

Site No.	Site Name	Site Description	Were Ordnance or Ordnance-Related Items Disposed at the Site?	Is There a Potential Pathway to Groundwater at the Site?	Is the Site Investigation Complete?	Is There a Decision Document in Place?	Are Monitoring Wells Available?	Evaluate Options	Conduct Groundwater Sampling	Perchlorate Sample Results
PRIORITY 1 SITES										
SITE 02	Fenced Ordnance Burial Area	Disposal of metal ordnance materials that may have contained explosive residues.	Yes	Yes	Yes	ROD – Remedial Action Completed Long-Term Monitoring	Yes		Yes, sampled from 2003 through 2007.	Ranged from non-detected to 0.5 ug/L
SITE 03	Ordnance Burn Structure	Thermally treated explosive or explosive-contaminated waste in burn pans, in a steel box, in the popping furnace structure, or on the ground surface.	Yes	No, the source has been removed.	Yes	Removal Action Completed ROD No Futher Action	Yes		Yes, sampled in 2003 and 2004.	Non-detected
SITE 09	Disposal/Burn Area	Evidence of waste disposal primarily derived from evaluation of aerial photography. Extensive ordnance was found at this site.	Yes	Yes	Yes	ROD – Remedial Action Completed Long-Term Monitoring	Yes		Yes, sampled in 2003.	Non-detected
SITE 10	Hideaway Pond	Man-made (dam) body of water in marshy area drains to Gambo Creek.	No			ROD - Long-Term Fish Monitoring				
SITE 12	Chemical Burn Area	Burning to destroy decontaminated chemical warfare solution neutralized by laboratory. Also land-farming of oil-contaminated materials.	No			ROD – Remedial Action Completed			Yes, sampled in 2003, 2004, 2006 and 2007.	Non-detected
SITE 17	1400 Area Landfill	Storage of crates and barrels, gravel mining and location of sanitary landfill. No live ordnance has been found at the site.	No			ROD – Remedial Action Completed Long-Term Monitoring				
SITE 19	Transformer Draining Area	1000 gallons of transformer oil was drained onto the ground. PCBs only.	No			Removal Action Completed ROD No Futher Action				
SITE 25	Pesticide Rinse Area	Rinsing of empty pesticide containers with wash water. Also slop sink in Bldg. 134 with french drain.	No			ROD – Remedial Action Completed				
SITE 29	Battery Service Area	Waste battery acids discharged to a pit filled with limestone for neutralization (10-15 gallons per month from an unknown time though 1982.	No			Removal Action Completed ROD - No Futher Action				
SITE 44	Rocket Motor Pit	From the early 1960's to 1994 this structure was used to anchor waste rocket motors while they were burned. The pit was unlined. Sites 3 & 44 combined because of common use and close proximity.	Yes	No, the source has been removed.	Yes	Removal Action Completed ROD No Futher Action	Yes		Yes, sampled in 2003 and 2004.	Non-detected
SITE 58	Building 1350 Landfill	Basically an extension of Site 9 – Disposal/Burn Area – where steel and concrete debris, roofing tar and paint were disposed.	No			ROD – Remedial Action Completed				
SITE 06	Terminal Range Airplane Park	Used for storage of metal items, planes, gun barrel preservative, sandblasting agent, RR ties, etc.	Yes	No, the source has been removed.	Yes	ROD – Remedial Action Completed	No		Yes, a sample will be collected from one of the on-site excavations.	
SITE 21	Gun Barrel Decoppering Area	Gun barrels dipped in acid to remove copper, lead, brass, tin, and residues from firing. Gun barrels drained on ground when raised from acid bath.	No			Removal Action Completed				
SITE 22	Gun Barrel Degreasing Area, North Main Range	Used to steam clean gun barrels on concrete pad. Also, two aboveground tanks, one with kerosene (formerly used mineral spirits) on-site.	No			Removal Action Completed				

TABLE 4-1
PERCHLORATE GROUNDWATER RESULTS
APPENDIX A
NAVAL SUPPORT FACILITY DAHLGREN

Site No.	Site Name	Site Description	Were Ordnance or Ordnance-Related Items Disposed at the Site?	Is There a Potential Pathway to Groundwater at the Site?	Is the Site Investigation Complete?	Is There a Decision Document in Place?	Are Monitoring Wells Available?	Evaluate Options	Conduct Groundwater Sampling	Perchlorate Sample Results
SITE 31	Airplane Park Dump, EEA	Dump for various solid wastes, aircraft and aircraft parts, scrap metal, waste explosive containers, wood, plastic, etc.	No			Removal Action Completed				
SITE 32	Fast Cook-off Pit and Pond, EEA	Pit and pond used to test munitions response to fire.	Yes	Yes	Yes	ROD – No Further Action	Yes		Yes, in 2004.	Non-detected.
SITE 45	July 28, 1992 Landfill B	Drainage area filled with solid wastes (car tires, cans, shingles, plumbing parts, construction rubble, empty powder casings). Used from the 1960s to early 1970s.	No			Cleanup Completed SSP - No Further Action				
SITE 46	July 28, 1992 Landfill A: Stump Dump Road	Two landfill locations dating from the early 1940s to late 1950s and another from before 1958 to about 1969. Wastes disposed included municipal waste, electrical components, construction debris, machine shop wastes.	No			ROD – Remedial Action Completed				
SITE 50	Fill Area Northeast EEA (objects)	From the 1940s to 1955, this area was used to dispose of aircraft parts and building debris.	No			Removal Action Completed				
SITE 51	Battery Locker Acid Draining Area	This area, located inside Building 338, was used for draining and refilling batteries (approximately 150 gallons per year were collected in the tank).	No			SSP – No Further Action				
SITE 53	OWS 207 300	This was a 300-gallon steel oil/water separator used to separate kerosene from gun barrel degreasing water. The resulting water was piped to the stormdrain. The separator was used from 1986 to 1992 and has since been removed.	No			Removal Action Completed				
SITE 55	Cooling Pond	The Cooling Pond collects stormwater discharge, oil/water separator discharges, and power generation cooling water. It has been in use from the 1920s to the present.	No			ROD – No Further Action				
PRIORITY 2 SITES										
SITE 13	Gambo Creek Truck Wash Area	Site used for truck washing. Also disposal area for rocks, cement/asphalt, construction debris, dredged creek sediments.	No			Removal Action Completed				
SITE 20	Former Electroplating Waste UST	From the 1960s to before 1984, a concrete UST consisting of concrete block with a composite liner was used to hold electroplating wastewater.	No			FFS completed, ROD planned for FY 07				
SITE 23	Building 480 Lot (PCB Storage)	From the 1960s on, this site has been used to store scrap metal items, transformers, electrical equipment, conduit, empty drums, facility vehicles.	No			FFS completed, ROD planned for FY 07				
SITE 37	Lead Contamination Area	This site has been used for the disposal of lead-laden and projectile-laden sands from the existing indoor machine gun range. The area is also an active shooting range.	Yes	Yes	Yes	ROD – Remedial Action Completed	Yes			

TABLE 4-1
PERCHLORATE GROUNDWATER RESULTS
APPENDIX A
NAVAL SUPPORT FACILITY DAHLGREN

Site No.	Site Name	Site Description	Were Ordnance or Ordnance-Related Items Disposed at the Site?	Is There a Potential Pathway to Groundwater at the Site?	Is the Site Investigation Complete?	Is There a Decision Document in Place?	Are Monitoring Wells Available?	Evaluate Options	Conduct Groundwater Sampling	Perchlorate Sample Results
SITE 56	Gun Barrel Degreasing Area, Railway Spur	From 1961 to 1975, this railway spur was used to store and degrease gun barrels. Potential contaminants include cosmoline, trace solvents, and metals.	No			SSP – No Further Action				
SITE 57	Shell House Dump	Materials placed on the ground surface at the site include rocket motor cases, aircraft parts, roofing tar, and 4 hedgehog bombs.	Yes	Yes	Yes	SSP completed, - No Further Action	Yes			
PRIORITY 3 SITES										
SITE 04	Case Storage Area	This site consists of a storage area for ordnance materials for inert certification, disposal and reuse. Empty projectile cases, ammunition containers, powder cases, rocket motor cases, and various equipment have been found at the site. The site has been used from the 1940s to the present.	Yes	Yes	Yes	EECA completed; Removal Action Underway	Yes		Yes, sampled in 2002.	Non-detected to 5 µg/L
SITE 14	CW Evaporation Pond	This site consists of a lined evaporation pond for disposal of solutions of decontaminated chemical warfare waste.	No		No	EECA completed; Removal Action planned for FY 07				
SITE 15	Scrap Area	From the 1940s to the present, this area has been used as a storage area for ordnance materials for inert certification, disposal and reuse. Empty projectile cases, ammunition containers, powder cases, rocket motor cases, various equipment, and wood and metal wastes have been disposed in this location.	Yes	Yes	Yes	EECA completed; Removal Action Underway	Yes		Yes, sampled in 2002.	Non-detected to 5 µg/L
SITE 38	Building 1349 Pest Control Outside Area	This is a gravel area used to stage trailers that carry pest control equipment including bulk pesticides and spray hoses. The area is also used to mix pesticides.	No			SSP Completed No Further Action				
SITE 40	Building 120B DRMO Lot	Since 1945, this site has been used to store new product supplies such as metal equipment, drums of hydraulic oil, motor oil, potassium hydroxide, and cleaning/degreasing solvents. Waste lead-acid batteries and scrap metal have also been found in this location.	No, found some ordnance on ground – old casings.			SSP Completed, No Further Action			Yes, sampled in 2002.	Non-detected.
SITE 43	Higley Road Land Application Area	In 1989, dried sewage sludge contaminated with wastewater treatment sludges from electroplating was land-applied.	No			SSP Completed, Removal Action Completed.				
SITE 61a	Gambo Creek Ash Dump	Dump materials at this site include bag gun primers, cartridge activated devices, partially burned pyrotechnic flares, active gun propellent, charred wood and steel cable.	Yes	No, site is at the point of groundwater discharge to surface water.	Yes	RI/FS Completed; ROD planned for FY 08	Yes	Yes, sample collected from marsh.	Yes, sampled in 2001, 2002 and 2006.	Non-detected.
SITE 62	Building 396	This site was used for oil and gun cleaning fluid storage associated with explosive testing activities. Interior cleaning sink drains to a french drain outside the building. Samples were not analyzed for explosives.	Yes	Yes	Yes	RI/FS completed, ROD identified No further action	Yes		Yes, sampled in 2002.	Non-detected.

Site No.	Site Name	Site Description	Were Ordnance or Ordnance-Related Items Disposed at the Site?	Is There a Potential Pathway to Groundwater at the Site?	Is the Site Investigation Complete?	Is There a Decision Document in Place?	Are Monitoring Wells Available?	Evaluate Options	Conduct Groundwater Sampling	Perchlorate Sample Results
PRIORITY 4 SITES										
SITE 01	Old Bombing Range	This is an 293-acre site used in the 1940s as an aerial bombing range.	Yes	Yes	No	No, not in IR program	No	Yes		
SITE 05	Projectile Disposal Area	This is a wetland area filled in with construction rubble, projectiles, ordnance excavated from the WWI munitions mound, and fill dirt.	Yes	Yes	No	No, not in IR program	No	Yes		
SITE 36	DU Mound Pumpkin Neck, EEA	This site consists of a grass-covered pile of earth where rounds of depleted uranium shells are imbedded. In use from the 1970s to 1990, the DU shells were fired into the mound to test trajectory. During the removal action, M-46 grenades were found.	Yes	No, the source area has been removed.	Yes	Remedial Action Completed ROD - No Further Action	No		No, the site is located on an active range.	
SITE 47a	WWI Munitions Mound	This area was in use from 1917 to the late 1930s. Live and dud WWI munitions were piled up and then covered over with dirt.	Yes	Yes	Yes	Removal Action Completed	No		Yes, sample collected from an open trench in 2002.	Non-detected.
SITE 47b	EOD Scrap Area	From before 1950 to the present, scrap metal and debris (metals, wood, electrical equipment, pipe conduit, glass and one 8-inch shell were placed in this area. There is a "high probability that live ordnance exists in this area."	Yes	Yes	Yes	Removal Action Completed	No		No, the source has been removed	
SITE 49	DU Gun Butt	This is an open steel sand butt used from the 1940s to 1991 to test depleted uranium shells. Projectiles fired into the sand are pulverized or abraded on impact resulting in a dust of metal and pulverized sand.	Yes	No, the source has been removed.	Yes	Remedial Action Completed	No		No, the source has been removed.	
SWMU 3	Building 194AA (Concrete Pad)	Drum on eroding concrete base. One drum of used aircraft oil cleared off concrete pad.	No			Closed Out				
SWMU 15	Building 120B Contractor Staging Area	Investigated site because used diesel fuel, used motor oil products, scrap metal, wood, were stored here while contractor was working on construction project.	No			Closed Out				
SWMU 20/Site 41	Compost Area	A storage area for wood chips, mulch, sawdust, and similar materials in several mounds.	No			Closed Out				
SWMU 23	Building 456 Oil Waste Drum	A 55-gallon drum for waste oil was situated on the ground with no secondary containment.	No			Closed Out				
SWMU 27	Tank 280 Contractor Staging Area	Three 55-gallon steel drums and smaller plastic drums containing waste oil, oily rags, oil product and possibly diesel fuel used by contractor.	No		Yes	Closed Out				
SWMU 57/Site 60	Building 445 Star Guage Loading Dock	Used for storage and handling of paint residues and gun barrel preservative containing tar and petroleum-based solvent.	No			Closed Out				
SWMU 61	Paint Can Crusher	This consists of a steel hydraulic press used to crush empty paint cans and an area used to store empty uncrushed paint cans.	No			Closed Out				

TABLE 4-1
PERCHLORATE GROUNDWATER RESULTS
APPENDIX A
NAVAL SUPPORT FACILITY DAHLGREN

Site No.	Site Name	Site Description	Were Ordnance or Ordnance-Related Items Disposed at the Site?	Is There a Potential Pathway to Groundwater at the Site?	Is the Site Investigation Complete?	Is There a Decision Document in Place?	Are Monitoring Wells Available?	Evaluate Options	Conduct Groundwater Sampling	Perchlorate Sample Results
SWMU 62	Paint Can Dumpster	This dumpster is used to store crushed paint cans and related paint shop waste prior to disposal.	No			Closed Out				
SWMU 64	Building 448 Sand Blast Area	Used for sandblasting paint from about 100 household radiators in 1992.	No			Closed Out				
SWMU 67	Building 448 Tar Tank Area	Two horizontally mounted tanks within secondary containment were used to store a heavy tar substance used for road repair.	No			Closed Out				
SWMU 70	Building 152 TCE AA	The unit consists of a small concrete pad and a hazardous materials locker that was used to store trichloroethane.	No			Closed Out				
SWMU 77	Building 1329 Wash Area	Concrete pad with a drain to an oil/water separator used to wash maintenance trucks.	No			Closed Out				
SWMU 78	Building 1121 Former Waste Oil UST	A 1,000-gallon steel UST used to contain motor oil from a slop sink inside the shop.	No			Closed Out				
SWMU 82	Electroplating Line and WWT	This unit consisted of six components used to treat electroplating wastewater.	No			Closed Out				
SWMU 101	Building 155 Auto Shop Waste Oil Filter and UST	Used for managing used automobile oil, the unit consists of 55-gallon drums with containment, a metal slop sink, and a 1,000-gallon fiberglass UST.	No			Closed Out				
SWMU 115	Building 1282 Auto Hobby Outside Used Oil Storage	An area outside Building 1282 used to store used oil and antifreeze.	No			Closed Out				
SWMU 119	Building 1282 Auto Hobby Used Oil Tank	This is an AST used to store used motor oil.	No			Closed Out				
SWMU 125/Site 52	OWS 107-350 (Yardcraft Area)	This is a 350-gallon below-grade baffled steel OWS inside a bermed concrete pad. Originally, it was used to separate oil from bilge water, before discharge to the sanitary sewer.	No			Closed Out				
SWMU 127	OWS 1121-300, OWS 115 350, OWS 402-30,000, and OWS 486-1000	These OWSs received wastewater that probably contained oil and grease from vehicle wash and maintenance operations, oil storage and parking lot run-off.	No		Yes	Closed Out				
SWMU 128/Site 54	OWS 1121-Old	An oil/water separator located south of Building 1121, made of baffled steel and concrete. The OWS likely received oil and grease washed from the floors of the building, where heavy machinery maintenance is performed.	No			Closed Out				
SWMU 130	Yardcraft Oil Storage Area	This is a 4-sided concrete pad with storage racks for up to five 55-gallon drums.	No			Closed Out				
SWMU 131/Site 28	Gambo Creek Compost Area	Storage of wood chips, mulch, sawdust, leaves, trees and similar materials.	No		Yes	Closed Out				

TABLE 4-1
PERCHLORATE GROUNDWATER RESULTS
APPENDIX A
NAVAL SUPPORT FACILITY DAHLGREN

Site No.	Site Name	Site Description	Were Ordnance or Ordnance-Related Items Disposed at the Site?	Is There a Potential Pathway to Groundwater at the Site?	Is the Site Investigation Complete?	Is There a Decision Document in Place?	Are Monitoring Wells Available?	Evaluate Options	Conduct Groundwater Sampling	Perchlorate Sample Results
AOC A	Otto Fuel Spill	A section of bare soil where a liquid propellant for torpedoes was spilled onto the soil in the 1970s. The soil was saturated with petroleum products and ignited to clean up the soil.	No			Closed Out				
AOC O	Building 1369 Pesticide Spill Area	An unvegetated area was created by a one-time leak from a pesticide sprayer in 1992.	No			Closed Out				
AOC X	Classified Documents Incinerator Sewage Holding Tank	This unit consists of a system which served as a sewage holding and dispersion system for the sanitary facility in the building.	No			Closed Out				
AOC X7/Site 39	Open Storage Area Main Battery	Ground staining noted in this area where gun barrels were stored and cleaned.	No			Closed Out				
AOC Z	Terminal Range Building 109	This unit is an open-topped, below-grade (and below the water table) structure used as a fuse chamber for testing projectile fuses.	Yes	No, the source has been removed.	Yes	Closed Out	No	No, the site is located on an active range.		
Other Units C3	Scar at Phalanx Test Area	A former rocket launch area covering about 5 acres. The launches (2.75 rocket and Zuni rockets) were conducted on the ground after the area had been removed of grass.	No, RDT+E operations, no solid waste.			Closed Out				
Other Units C6	Former Radio Testing Area	Discharges were noted on aerial photography from two trailers used to test radar or microwave radio equipment.	No			Closed Out				
Additional Area X6	South Hangar Former Tank Area	A horizontal tank with a stain following the drainage was noted on aerial photography.	No			Closed Out				
Site 59	Octagon Pad Dump, EEA	This was a scrap metal accumulation area, where used metal target and ordnance test items were collected and stored awaiting proper disposal.	Yes	No, the source has been removed.	Yes	Closed Out	No	No, the site is located on an active range.	No	
Site 61b	Gambo Creek Projectile Disposal Area	This site was in use from the late 1930s to the early 1940s. It consists of a pile of gun projectiles (either fired from a gun or used for ordnance testing, consistent with waste material from old range gun butts) along with small pieces of scrap metal and sand.	Yes	No, site is at the point of groundwater discharge to surface water.	Yes	Closed Out	No		Yes, sample collected from water in excavation in 2003.	Non-detected.
	Building 198 Neutralization Tank	The primary function of the tank was to neutralize acid waste discharged from a physics laboratory that was housed within building 198. The types of wastes reportedly discharged to the tank included polymers, solvents, acids, heavy metals, and potentially explosive residue.	Yes	Yes	No	Site Investigation Completed	No		No	

5.0 SITE MANAGEMENT SCHEDULES

The purpose of this section is to present project schedules for all Appendix A sites. The Appendix A sites at NSF Dahlgren have been divided into five categories: IR, Priority 1, Priority 2, Priority 3, and Priority 4.

The project schedules for the Appendix A sites include a listing of FY 2008 and FY 2009 activities (as of June 15, 2008) for each site and the associated deliverables. Funded activities are those that are scheduled in FY 2008 and budgeted for FY 2009. The sites in Table 5-1 are grouped according to priority.

If additional funds, beyond what was budgeted and received, are required for individual tasks, a slippage in schedule or phasing of the task may be required. A schedule for the Gambo Creek Ecological Assessment is not provided, however, the Phase II EA report was issued in September 2003 and supplemental sediment sampling was completed in October 2006. Additionally, an Environmental GIS Database (TtNUS, 1999b) has been submitted to help identify and evaluate contaminant trends along Gambo Creek.

TABLE 5-1

APPENDIX A SITE MANAGEMENT SCHEDULE
NSF DAHLGREN
PAGE 1 OF 3

Site No.	Site Name	Current Phase and Scheduled Actions (as of June 15, 2008)
IR		
SITE 2	Fenced Ordnance Burial Area	ROD - Remedial Action Completed Long-Term Monitoring Underway 2003 Five-Year Review Completed 2008 Five-Year Review Fall 2008
SITE 3	Ordnance Burn Structure	Removal Action Completed ROD – No Further Action
SITE 9	Disposal/Burn Area	ROD – Remedial Action Completed Long-Term Monitoring Underway 2003 Five-Year Review Completed 2008 Five-Year Review Fall 2008 Methane Monitoring June 2008 Wetland Monitoring June 2008 and Fall 2008 Benthic Monitoring June 2009 Groundwater Monitoring January 2009 Surface & Sediment Monitoring January 2008
SITE 10	Hideaway Pond	ROD - Long-Term Monitoring Underway 2003 Five-Year Review Completed 2008 Five-Year Review Fall 2008 Fish Tissue Sampling October 2008
SITE 12	Chemical Burn Area	ROD – Selected Remedial Action Completed ESD Completed 2003 Five-Year Review Completed 2008 Five-Year Review Fall 2008 UFP-SAP in Review SAR Underway Contingent Remedy Implementation Underway
SITE 17	1400 Area Landfill	ROD – Remedial Action Completed Long-Term Monitoring Underway 2003 Five-Year Review Completed 2008 Five-Year Review Fall 2008 Methane Monitoring June 2008 Wetland Monitoring June 2008 and Fall 2008 Groundwater Monitoring January 2009 Surface & Sediment Monitoring January 2008 Methane Mitigation Trench in Planning
SITE 19	Transformer Draining Area	Removal Action Completed ROD – No Further Action
SITE 25	Pesticide Rinse Area	ROD – Remedial Action Completed Wetland Monitoring June 2008 and Fall 2008 Benthic Monitoring June 2009
SITE 29	Battery Service Area	Removal Action Completed ROD – No Further Action
SITE 44	Rocket Motor Pit	Removal Action Completed ROD – No Further Action
SITE 58	Building 1350 Landfill	ROD – Remedial Action Completed 2003 Five-Year Review Completed 2008 Five-Year Review Fall 2008

TABLE 5-1

APPENDIX A SITE MANAGEMENT SCHEDULE
NSF DAHLGREN
PAGE 2 OF 3

Site No.	Site Name	Current Phase and Scheduled Actions (as of June 15, 2008)
Priority 1		
SITE 6	Terminal Range Airplane Park	ROD – Remedial Action Completed Wetland Monitoring June 2008 and Fall 2008 Benthic Monitoring June 2009
SITE 21	Gun Barrel Decoppering Area	Removal Action Completed Decision Document – No Further Action
SITE 22	Gun Barrel Degreasing Area, North Main Range	Removal Action Completed Decision Document – No Further Action
SITE 31	Airplane Park Dump, EEA	Removal Action Completed ROD - No Further Action
SITE 32	Fast Cook-off Pit and Pond, EEA	RI/FS Completed ROD - No Further Action
SITE 45	July 28, 1992 Landfill B	Removal Action Completed Decision Document – No Further Action
SITE 46	July 28, 1992 Landfill A: Stump Dump Road	ROD – Remedial Action Completed Wetland Monitoring June 2008 and Fall 2008 Benthic Monitoring June 2009
SITE 50	Fill Areas Northeast EEA	Removal Action Completed Decision Document – No Further Action Wetland Monitoring June 2008 and Fall 2008 Benthic Monitoring June 2009
SITE 51	Battery Locker Acid Draining Area	SSP Completed – No Further Action
SITE 53	OWS 207 300	Removal Action Completed Decision Document – No Further Action
SITE 55	Cooling Pond	RI/FS Completed ROD - No Further Action
Priority 2		
SITE 13	Gambo Creek Truck Wash Area	Removal Action Completed Decision Document – No Further Action
SITE 20	Former Electroplating Waste UST	FFS Completed ROD Complete Remedial Action (Soil) Complete Remedial Action Groundwater in Progress
SITE 23	Building 480 Lot (PCB Storage)	FFS Completed ROD Complete Remedial Action (Soil) Complete
SITE 37	Lead Contamination Area	ROD Amendment Completed Remedial Action Completed
SITE 56	Gun Barrel Degreasing Area, Railway Spur	SSP Completed Decision Document – No Further Action
SITE 57	Shell House Dump	SSP Technical Memorandum, Additional Sampling March 2009

TABLE 5-1

**APPENDIX A SITE MANAGEMENT SCHEDULE
NSF DAHLGREN
PAGE 3 OF 3**

Site No.	Site Name	Current Phase and Scheduled Actions (as of June 15, 2008)
Priority 3		
SITE 4	Case Storage Area	EE/CA Completed VSAP Completed ESS & SAR in Review Removal Action Pending Approval
SITE 14	CW Evaporation Pond	EE/CA Completed Removal Action (Soil) Completed Pipe Removal Planned Fall/Winter 2008
SITE 15	Scrap Area	EE/CA Completed VSAP Completed ESS & SAR in Review Removal Action Pending Approval
SITE 38	Building 1349 Pest Control Outside Area	SSP Completed Decision Document – No Further Action
SITE 40	Building 120B DRMO Lot	SSP Completed Decision Document – No Further Action
SITE 43	Higley Road Land Application Area	Removal Action Completed Decision Document – No Further Action
SITE 61a	Gambo Creek Ash Dump	FFS Completed ROD Underway ESS Mid-2008 Removal Action Late-2008
SITE 62	Building 396	RI/FS Completed Removal Action Completed ROD – No Further Action
Priority 4		
SITE 1	Old Bombing Range	Decision Document – Action is deferred until the range is closed or transferred.
SITE 5	Projectile Disposal Area	Decision Document – Action is deferred until the range is closed or transferred.
SITE 36	Depleted Uranium Mound, Pumpkin Neck, EEA	Removal Action Completed ROD – No Further Action
SITE 47a	WWI Munitions Mound	EE/CA Completed Removal Action Completed Decision Document – No Further Action
SITE 47b	EOD Scrap Area	EE/CA Completed Removal Action Completed Decision Document – No Further Action
SITE 49	Depleted Uranium Gun Butt	Removal Action Completed ROD – No Further Action

* Sites to be removed from ER, N funded sites.

6.0 SITE NAME CROSS REFERENCE

TABLE 6-1

**SITE NAME/NUMBER CROSS REFERENCE LIST
NSF DAHLGREN
PAGE 1 OF 2**

NAVY SITE NUMBER	EPA NUMBER	DESCRIPTION, (IAS Site Name) / (EPA Site Name)
Site 1	AOC J	Old Bombing Range
Site 2	SWMU 46	Fenced Ordnance Burial Area
Site 3	SWMU 42	Ordnance Burn Structure
Site 4		Case Storage Area
Site 5	SWMU 51	Projectile Disposal Area
Site 6	SWMU 54	Terminal Range Airplane Park
Site 7		Explosive Mat. Sure. Cont. (EEA)
Site 8		Bombing Area (EEA)
Site 9	SWMU 19	Disposal/Burn Area
Site 10	AOC N	Mercury Contamination at Hideaway Pond
Site 11		Wood/brush Disposal Area
Site 12	SWMU 44	Chemical Burn Pit
Site 13	SWMU 31	(Inert Disposal Area)/(Gambo Creek Truck Wash Area)
Site 14	SWMU 28	CW Evaporation Pond
Site 15		Scrap area
Site 16		Oil Leak (Tank #280)
Site 17	SWMU 30	(Old Sanitary Landfill)/ (1400 Area Landfill)
Site 18	AOC X	Incinerator Effluent Discharge
Site 19	AOC G	Transformer Draining Area
Site 20	SWMU 83	Former Electroplating Waste UST
Site 21	SWMU 52	Gun Barrel Decoppering Facility
Site 22	SWMU 53	Gun Barrel Degreasing Facility
Site 23	SWMU 72	(PCB Outside Storage)/(Building 480 Lot)
Site 24		Sewage Collection/Treatment
Site 25	SWMU 66	Pesticide Rinse Area
Site 26		PCB Inside Storage
Site 27		Scrap Metal
Site 28	SWMU 131	(Compost Pile)/(Gambo Creek Compost Area)
Site 29	SWMU 79	Battery Service Area
Site 30		Wide Scale Herbicide Application (EEA)
Site 31	SWMU 6	Metal Disposal Area (EEA)/(Airplane Park Dump)
Site 32	AOC F	Rapid Cook-off Area, Pit and Pond (EEA)
Site 33	AOC A	Otto Fuel Spill
Site 34		Barbette/DU Contamination
Site 35		Thorium-MG Misch Metal
Site 36	AOC C1	Depleted Uranium Mound (EEA)
Site 37	SWMU 108	Lead Contaminated Area

TABLE 6-1

SITE NAME/NUMBER CROSS REFERENCE LIST
NSF DAHLGREN
PAGE 2 OF 2

NAVY SITE NUMBER		EPA NUMBER		DESCRIPTION, (IAS Site Name) / (EPA Site Name)
Site	38	AOC	I	Building 1349 Pest Control Outside Area
Site	39	AOC	X7	Open Storage Area Main Battery
Site	40	SWMU	14	Building 120B DRMO Lot
Site	41	SWMU	20	Compost Area
Site	42	SWMU	31	Gambo Creek Truck Wash Area
Site	43	SWMU	35	Higley Road Land Application Area
Site	44	SWMU	41	Rocket Motor Pit
Site	45	SWMU	45	July 28, 1992 Landfill B
Site	46	SWMU	47	July 28, 1992 Landfill A, Stump Dump Rd.
Site	47a	SWMU	50	WWI Munitions Mound
Site	47b	AOC	K	EOD Scrap Area
Site	48	SWMU	67	Building 448 Oil Storage Area
Site	49	AOC	C4	DU Contaminated Firing Butt (Main-Side)
Site	50	SWMU	X9	Fill Area Northeast (EEA)
Site	51	SWMU	98	Battery Locker Acid Draining Area
Site	52	SWMU	125	OWS 107-350
Site	53	SWMU	126	OWS 207-300
Site	54	SWMU	128	OWS 1121 - OLD
Site	55	SWMU	129	Cooling Pond
Site	56	SWMU	132	Gun Barrel Degreasing Area, Railway Spur
Site	57	SWMU	133	Shell House Dump
Site	58	SWMU	134	Building 1350 Landfill
Site	59	SWMU	135	Octagon Pad Dump
Site	60	SWMU	57	Building 445 Star Gauge Loading Dock
Site	61a			Gambo Creek Ash Dump
Site	61b			Gambo Creek Projectile Disposal Area
Site	62			Building 396
				Building 198 – Neutralization Tank

REFERENCES

Allied Technology Group, Inc., and Geo/Resource Consultants, Inc., 1997. Final Engineering Evaluation/Cost Analysis, NSWC, Dahlgren, VA, February.

B&R Environmental, 1995. Draft Final Remedial Investigation Report, NSWC, Dahlgren, Virginia, September.

B&R Environmental, 1996a. Final Site Screening Process, Priority 1 Sites, NSWC, Dahlgren, Virginia, March.

B&R Environmental, 1996b. Final Master Plans Environmental Investigations, Project Plans Remedial Investigation Phase I & II, NSWC, Virginia, April.

B&R Environmental, 1996c. Final Site Screening Process, Phase II, Priority 2 Sites, NSWC, Dahlgren, Virginia, July.

B&R Environmental, 1997. Draft Site Screening Process Report, Priority 2 Sites, NSWC, Dahlgren, Virginia, October.

B&R Environmental, 1998a. Final Engineering Evaluation/Cost Analysis, Site 3/44, Ordnance Burn Structure/Rocket Motor Pit, May.

B&R Environmental, 1998b. Phase I Air Sparging/Soil Vapor Extraction (AS/SVE) Treatability Study for Site 12 – Chemical Burn Area at Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, July.

CH_2M Hill, 2001a. Final Work Plan for the Site Screening Process at Sites 40, 43, and 61b and Remedial Investigation at Sites 61a and 62 for Naval Surface Warfare Center, , Dahlgren, Virginia, August.

CH_2M Hill, 2001b. Final Work Plan for the Site Screening Process at Sites 4, 14, 15, and 38 for Naval Surface Warfare Center, Dahlgren, Virginia, November.

CH_2M Hill, 2002. Final Site Screening Process Report, Sites 40, 43, and 61b, Naval Surface Warfare Center, Dahlgren Division, Dahlgren, Virginia, October.

CH_2M Hill, 2004a. Draft Final Focused Feasibility Study for Site 61a, Naval Support Facility Dahlgren, Dahlgren, Virginia, June.

CH_2M Hill, 2004b. Engineering Evaluation/Cost Analysis for Site 62, Naval Support Facility Dahlgren, Dahlgren, Virginia, June.

CH_2M Hill, 2004c. Final Remedial Investigation for Site 61a, Naval Support Facility Dahlgren, Dahlgren, Virginia, September.

CH_2M Hill, 2005a. Final Remedial Investigation/Feasibility Study for Site 62, Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

CH_2M Hill, 2005b. Proposed Remedial Action Plan for Site 62, Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

CH_2M Hill, 2005c. Final Record of Decision for Site 62, Naval Support Facility Dahlgren, Dahlgren, Virginia, August.

CH_2M Hill, 2005d. Final Site Screening Process at Sites 4, 14, 15, and 38 for Naval Support Facility Dahlgren, Dahlgren, Virginia.

CH_2M Hill, 2005f. Site Close-Out Decision Document Appendix A, Priority 3 Site 40, Naval Support Facility Dahlgren, Dahlgren, Virginia.

CH_2M Hill, 2006a. Sampling Strategy for Groundwater and Sediment at Site 61a for Naval Support Facility Dahlgren, Dahlgren, Virginia, January.

CH_2M Hill, 2006b. Final Engineering Evaluation/Cost Analysis at Site 14, Chemical Waste Evaporation Pond for Naval Support Facility Dahlgren, Dahlgren, Virginia, April.

CH_2M Hill, 2006c. Final Action Memorandum for Site 14, Chemical Waste Evaporation Pond for Naval Support Facility Dahlgren, Dahlgren, Virginia, September.

CH_2M Hill, 2006d. Sampling and Analysis Investigation Report for Building 198 Neutralization Tank, Naval Support Facility Dahlgren, Dahlgren, Virginia, September.

CH_2M Hill, 2006e. Sampling and Analysis Report for Site 61a, Naval Support Facility Dahlgren, Dahlgren, Virginia, December.

CH_2M Hill, 2007. Preconstruction Work Plan Addendum for Phase I Sampling and Fluid Evacuation Activities, Site 14 – Former Chemical Decontamination Building Discharge Pipeline, Naval Support Facility Dahlgren, Dahlgren, Virginia, November.

Field Support Services, Inc., 2006. Final Summary Closeout Report for Marsh Cap Repairs at Site 9 Landfill Area, NSF Dahlgren, Dahlgren, VA, October.

Fred C. Hart Associates, Inc, 1983. Initial Assessment Study of NSWC Dahlgren Laboratory, Dahlgren, Virginia, Prepared for NACIP Department, May.

Geophex, 1993. Final Report, Preliminary Site Investigation of Contamination at the Cooling Pond, NSWC, Dahlgren, Virginia, September.

Geophex, 1997. Final Report, Site Characterization at Building 396, NSWC, Dahlgren, VA, November.

Halliburton NUS, 1993a. Work Plan for Site Screening Process at SWMUs #61, 62, 64, and 67, NSWC, Dahlgren, Virginia, July.

Halliburton NUS, 1993b. Draft Site Screening Process Report for Solid Waste Management Units #61, 62, 64, and 67, NSWC, Dahlgren, Virginia, August.

JM Waller Associates, 2004a. Draft 2003 Annual Wetlands Monitoring Report, January.

JM Waller Associates, 2004b. Final Operations and Maintenance Manual for Landfill Sites 2, 9, and 17, NSF Dahlgren, Dahlgren, VA, May.

JM Waller Associates, 2004c. Final Engineering Evaluation/ Cost Analysis for Sites 4 and 15, NSF Dahlgren, Dahlgren, VA, June.

JM Waller Associates, 2004d. Final Five-Year Review Report for Sites 9, 10, `12, and 17, NSF Dahlgren, Dahlgren, VA, December.

JM Waller Associates, 2005a. Draft 2004 Annual Wetlands Monitoring Report, NSF Dahlgren, Dahlgren, VA, January.

JM Waller Associates, 2005b. Final Decision Document for Site 61b, NSF Dahlgren, Dahlgren, VA, February.

JM Waller Associates, 2006. Draft 2005 Annual Wetlands Monitoring Report, NSF Dahlgren, Dahlgren, VA, January.

JM Waller Associates, 2007a. Draft 2006 Annual Wetlands Monitoring Report, NSF Dahlgren, Dahlgren, VA, January.

JM Waller Associates, 2007b. Biennial Surface Water and Sediment Monitoring Report for Site 2 – Round 3, Naval Support Facility Dahlgren, Dahlgren, Virginia, January.

JM Waller Associates, 2007c. Biennial Surface Water and Sediment Monitoring Report for Site 9 – Round 3, Naval Support Facility Dahlgren, Dahlgren, Virginia, January.

JM Waller Associates, 2007d. Biennial Surface Water and Sediment Monitoring Report for Site 17 – Round 3, Naval Support Facility Dahlgren, Dahlgren, Virginia, January.

JM Waller Associates, 2007e. Benthic Macroinvertebrate Investigation of Wetland Mitigation Projects, Naval Support Facility Dahlgren, Dahlgren, Virginia, November.

NRC (Nuclear Regulatory Commission), 2002. Letter to Chief of Naval Operations, Department of the Navy, from Chief of Materials Licensing/Inspection Branch 2 of the Nuclear Regulatory Commission, regarding NRC Inspection Report No. 45-23645-01NA/00-06, January 8.

O'Brien & Gere, 1986a. NACIP Confirmation Studies at NSWC, Dahlgren, Virginia, Volume I and II, February.

O'Brien & Gere, 1986b. NACIP Groundwater Monitoring Plan for NSWC, Dahlgren, Virginia, February.

OHM Remediation Services Corp., 1998. Final Report for Sites 29, 54, SWMUs 45, 52, 53, 77, 78 & 126, October 13.

OHM Remediation Services Corp., 2000. Final Closure Report for Site 9, Dahlgren, Virginia, November.

RETEC, 1998. Final Report, Earthworm Bioaccumulation Study for Pesticide-Contaminated Soils, Naval

Surface Warfare Center, Dahlgren, Virginia, April.

TtNUS (Tetra Tech NUS, Inc.), 1997. Record of Decision for Site 2, Fenced Ordnance Burial Area, for Naval Surface Warfare Center, Dahlgren, Virginia, September.

TtNUS (Tetra Tech NUS, Inc.), 1998. Engineering Evaluation/Cost Analysis for Site 44, Rocket Motor Pit, Naval Warfare Center, Dahlgren, Virginia, November.

TtNUS (Tetra Tech NUS, Inc.) 1999a. Final Closure Design, Site 9 for Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, February.

TtNUS (Tetra Tech NUS, Inc.), 1999b. NSWCDL Environmental GIS Database, December.

TtNUS (Tetra Tech NUS, Inc.), 2000a. Remedial Investigation/Focused Feasibility Study, Site 3/44 for Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, July.

TtNUS (Tetra Tech NUS, Inc.), 2000b. Engineering Evaluation/Cost Analysis for Site 50, Fill Area Northeast (Objects), for Naval Surface Warfare Center, Dahlgren, Virginia, December.

TtNUS (Tetra Tech NUS, Inc.), 2001a. Remedial Investigation, Site 46 for Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, March.

TtNUS (Tetra Tech NUS, Inc.), 2001b. Engineering Evaluation/Cost Analysis for Site 31, Airplane Park Dump, Naval Surface Warfare Center, Dahlgren, Virginia, March.

TtNUS (Tetra Tech NUS, Inc.), 2001c. Site Screening Process, Priority 2 Sites, Phase II Project Plans Addendum for Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, April.

TtNUS (Tetra Tech NUS, Inc.), 2001d. Post-Remedial Action Report for Site 25, Pesticide Rinse Area, for Naval Surface Warfare Center, Dahlgren, Virginia, December.

TtNUS (Tetra Tech NUS, Inc.), 2001e. Post-Removal Action Report for Site 50, Fill Area Northeast (Objects), for Naval Surface Warfare Center, Dahlgren, Virginia, December.

TtNUS (Tetra Tech NUS, Inc.), 2001f. Monitoring Report Site 10, Hideaway Pond, Year One, October 2001, Naval Surface Warfare Center, Dahlgren, Virginia, December.

TtNUS (Tetra Tech NUS, Inc.), 2002a. Remedial Investigation Site 20 Volumes I, II, and III for Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, February.

TtNUS (Tetra Tech NUS, Inc.), 2002b. Remedial Investigation Site 55 Volumes I, II, and III for Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, July.

TtNUS (Tetra Tech NUS, Inc.), 2002c. Periodic Groundwater Monitoring Report for Site 2 – Round 1, Naval Surface Warfare Center NSFD, Dahlgren, Virginia, July.

TtNUS (Tetra Tech NUS, Inc.), 2002d. Periodic Groundwater Monitoring Report for Site 9 – Round 1, Naval Surface Warfare Center NSFD, Dahlgren, Virginia, July.

TtNUS (Tetra Tech NUS, Inc.), 2002e. Periodic Groundwater Monitoring Report for Site 17 – Round 1, Naval Surface Warfare Center NSFD, Dahlgren, Virginia, July.

TtNUS (Tetra Tech NUS, Inc.), 2003a. Biennial Surface Water and Sediment Monitoring Report for Site 2 – Round 1, Naval Surface Warfare Center NSFD, Dahlgren, Virginia, March.

TtNUS (Tetra Tech NUS, Inc.), 2003b. Biennial Surface Water and Sediment Monitoring Report for Site 9 – Round 1, Naval Surface Warfare Center NSFD, Dahlgren, Virginia, March.

TtNUS (Tetra Tech NUS, Inc.), 2003c. Biennial Surface Water and Sediment Monitoring Report for Site 17 – Round 1, Naval Surface Warfare Center NSFD, Dahlgren, Virginia, March.

TtNUS (Tetra Tech NUS, Inc.), 2003d. Feasibility Study Site 55 for Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, May.

TtNUS (Tetra Tech NUS, Inc.), 2003e. Periodic Groundwater Monitoring Report for Site 2 – Round 2, Naval Surface Warfare Center NSFD, Dahlgren, Virginia, May.

TtNUS (Tetra Tech NUS, Inc.), 2003f. Periodic Groundwater Monitoring Report for Site 9 – Round 2, Naval Surface Warfare Center, Dahlgren, Virginia, May.

TtNUS (Tetra Tech NUS, Inc.), 2003g. Periodic Groundwater Monitoring Report for Site 17 – Round 2, Naval Surface Warfare Center , Dahlgren, Virginia, May.

TtNUS (Tetra Tech NUS, Inc.), 2003h. Engineering Evaluation/Cost Analysis for Sites 47a – World War 1

Munitions Mound, and 47b EOD Scrap Area, Naval Surface Warfare Center, Dahlgren, Virginia, July.

TtNUS (Tetra Tech NUS, Inc.), 2003i. Five-Year Review Report for Site 2, Naval Surface Warfare Center, Dahlgren, Virginia, September.

TtNUS (Tetra Tech NUS, Inc.), 2004a. Periodic Groundwater Monitoring Report for Site 2 – Round 3, Naval Surface Warfare Center , Dahlgren, Virginia, January.

TtNUS (Tetra Tech NUS, Inc.), 2004b. Periodic Groundwater Monitoring Report for Site 9 – Round 3, Naval Surface Warfare Center , Dahlgren, Virginia, January.

TtNUS (Tetra Tech NUS, Inc.), 2004c. Periodic Groundwater Monitoring Report for Site 17 – Round 3, Naval Surface Warfare Center , Dahlgren, Virginia, January.

TtNUS (Tetra Tech NUS, Inc.), 2004d. Federal Facility Agreement, Appendix B Site Close-Out Package, C6 – Former Radio Testing Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, June.

TtNUS (Tetra Tech NUS, Inc.), 2004e. Site Close-Out Decision Document Appendix A, Priority 3 Site 43, - Higley Road Land Application Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, August.

TtNUS (Tetra Tech NUS, Inc.), 2004f. Feasibility Study for Site 37, Naval Support Facility Dahlgren, Dahlgren, Virginia, August.

TtNUS (Tetra Tech NUS, Inc.), 2004g. Monitoring Report Site 10, Hideaway Pond, Year Three, October 2003, Naval Surface Warfare Center , Dahlgren, Virginia, December.

TtNUS (Tetra Tech NUS, Inc.), 2005a. Remedial Investigation Site 20 Volumes I, II, and III for Naval Support Facility Dahlgren, Dahlgren, Virginia, February.

TtNUS (Tetra Tech NUS, Inc.), 2005b. Periodic Groundwater Monitoring Report for Site 2 – Round 4, Naval Support Facility Dahlgren, Dahlgren, Virginia, February.

TtNUS (Tetra Tech NUS, Inc.), 2005c. Periodic Groundwater Monitoring Report for Site 9 – Round 4, Naval Support Facility Dahlgren, Dahlgren, Virginia, February.

TtNUS (Tetra Tech NUS, Inc.), 2005d. Periodic Groundwater Monitoring Report for Site 17 – Round 4, Naval Support Facility Dahlgren, Dahlgren, Virginia, February.

TtNUS (Tetra Tech NUS, Inc.), 2005e. Biennial Surface Water and Sediment Monitoring Report for Site 2 – Round 2, Naval Support Facility Dahlgren, Dahlgren, Virginia, April.

TtNUS (Tetra Tech NUS, Inc.), 2005f. Biennial Surface Water and Sediment Monitoring Report for Site 9 – Round 2, Naval Support Facility Dahlgren, Dahlgren, Virginia, April.

TtNUS (Tetra Tech NUS, Inc.), 2005g. Biennial Surface Water and Sediment Monitoring Report for Site 17 – Round 2, Naval Support Facility Dahlgren, Dahlgren, Virginia, April.

TtNUS (Tetra Tech NUS, Inc.), 2005h. Gambo Creek Waste Removal and Wetlands Restoration Fact Sheet for Site 6, Terminal Range Airplane Park, Naval Support Facility Dahlgren, Dahlgren, Virginia.

TtNUS (Tetra Tech NUS, Inc.), 2005i. Periodic Groundwater Monitoring Report for Site 17 – Round 5, Naval Support Facility Dahlgren, Dahlgren, Virginia, August.

TtNUS (Tetra Tech NUS, Inc.), 2005j. Periodic Groundwater Monitoring Report for Site 9 – Round 5, Naval Support Facility Dahlgren, Dahlgren, Virginia, September.

TtNUS (Tetra Tech NUS, Inc.), 2005k. Periodic Groundwater Monitoring Report for Site 2 – Round 5, Naval Support Facility Dahlgren, Dahlgren, Virginia, October.

TtNUS (Tetra Tech NUS, Inc.), 2005l. Final Proposed Remedial Action Plan for Site 37- Lead Contamination Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, November.

TtNUS (Tetra Tech NUS, Inc.), 2006a. Landfill Gas Monitoring for Site 17, Naval Support Facility Dahlgren, Dahlgren, Virginia, March.

TtNUS (Tetra Tech NUS, Inc.), 2006b. ROD Amendment for Site 37 – Lead Contamination Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, August.

TtNUS (Tetra Tech NUS, Inc.), 2006c. Master Work Plan for Long Term Monitoring, Naval Support Facility Dahlgren, Dahlgren, Virginia, September.

TtNUS (Tetra Tech NUS, Inc.), 2006d. Site Close-out Package for SWMU 128 – Site 54 OWS, Naval Support Facility Dahlgren, Dahlgren, Virginia, September.

TtNUS (Tetra Tech NUS, Inc.), 2006e. Periodic Groundwater Monitoring Report for Site 2 – Round 6, Naval Support Facility Dahlgren, Dahlgren, Virginia.

TtNUS (Tetra Tech NUS, Inc.), 2006f. Periodic Groundwater Monitoring Report for Site 9 – Round 6, Naval Support Facility Dahlgren, Dahlgren, Virginia.

TtNUS (Tetra Tech NUS, Inc.), 2006g. Periodic Groundwater Monitoring Report for Site 17 – Round 6, Naval Support Facility Dahlgren, Dahlgren, Virginia.

TtNUS (Tetra Tech NUS, Inc.), 2006h. Monitoring Report Site 10, Hideaway Pond, Year Five, October 2006, Naval Support Facility Dahlgren, Dahlgren, Virginia, December.

TtNUS, 2007a. Draft Gambo Creek Sediment Sampling – October 2006, Naval Support Facility Dahlgren, Dahlgren, Virginia, January.

TtNUS, 2007b. Focused Feasibility Study, Sites 20 and 23, Naval Support Facility Dahlgren, Dahlgren, Virginia, March.

TtNUS, 2007c. Technical Memorandum 2006 Sampling Results and Remedy Evaluation for Site 12 Chemical Burn Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, April.

TtNUS, 2007d. Periodic Groundwater Monitoring Report for Site 2-Round 7, Naval Support Facility Dahlgren, Dahlgren, Virginia, December.

TtNUS, 2007e. Landfill Gas Migration Plan, Site 17 - 1400 Area Landfill, Naval Support Facility Dahlgren, Dahlgren, Virginia, December.

TtNUS, 2007f. ROD Sites 20 and 23, Naval Support Facility Dahlgren, Dahlgren, Virginia, December.

TtNUS, 2008. Technical Memorandum Gambo Creek October 2006 Sediment Sampling, Naval Support Facility Dahlgren, Dahlgren, Virginia, December.

USEPA (U.S. Environmental Protection Agency), 1991. National Priorities List (NPL), HRS Documentation for NSWC-Dahlgren, Dahlgren, Virginia, August.

USEPA (U.S. Environmental Protection Agency), 1992. Study Area Analysis, NSWC, Dahlgren, Virginia. Prepared for the U.S. Navy by Environmental Monitoring Systems Lab, Las Vegas, Nevada, November.

USEPA (U.S. Environmental Protection Agency), 1993. Letter from USEPA to EFACHES, Subject: Priority Ranking of Sites at the NSWC, Dahlgren, Virginia, February 17.

U.S. Navy, 1996a. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 15, Building 120B Contractor Staging Area, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, June.

U.S. Navy, 1996b. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 70, B-152 TCA AA, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, June.

U.S. Navy, 1996c. Federal Facility Agreement Appendix B Site Close-Out Package, AOC A, Otto Fuel Spill, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, June.

U.S. Navy, 1996d. Federal Facility Agreement Appendix B Site Close-Out Package, AOC O, B-1369 Pesticide Spill Area, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, June.

U.S. Navy, 1996e. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 23, Building 456 Oil Waste Drum, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, June.

U.S. Navy, 1997a. Engineering Evaluation/Cost Analysis (EE/CA) for Site 29, Battery Service Area, SWMU 78, Building 1121 Former Waste Oil UST, SWMU 128, OWS 1121-Old, SWMU 77, Building 1329 Wash Area, SWMU 52, Gun Barrel Decoppering Area, SWMU 53, Gun Barrel Degreasing Area, SWMU 126, OWS 207-300, Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, May.

U.S. Navy, 1997b. Record of Decision, Site 12, Chemical Burn Area, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

U.S. Navy, 1998a. Record of Decision, Site 9, Disposal/Burn Area, Naval surface Warfare Center Dahlgren, Dahlgren Virginia, September.

U.S. Navy, 1998b. Record of Decision, Site 17, 1400 Area Landfill, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

U.S. Navy, 1999a. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 3, Building

194A (Concrete Pad), for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, May.

U.S. Navy, 1999b. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 57, B-445 Star Gauge Loading Dock, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, May.

U.S. Navy, 1999c. Federal Facility Agreement Appendix B Site Close-Out Package, AOC X7, Open Storage Area Main Battery, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, May.

U.S. Navy, 1999d. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 62, Paint Can Crusher, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, July.

U.S. Navy, 1999e. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 64, Building 448 Sand Blast Area, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, July.

U.S. Navy, 1999f. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 130, Yardcraft Oil Storage Area, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, September.

U.S. Navy, 1999g. Record of Decision, Site 19 Transformer Draining Area (Soils), Site 29, Battery Service Area (Groundwater and Soils), for the Naval Surface Warfare Center, , Dahlgren, Virginia, September.

U.S. Navy, 1999h. Record Decision, Site 25, Pesticide Rinse Area, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

U.S. Navy, 1999i. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 78, Building 1121 Former Waste Oil Underground Storage Tank, for the Naval Surface Warfare Center, Dahlgren Laboratory, Dahlgren, Virginia, November.

U.S. Navy, 2000a. Proposed Remedial Action Plan, Site 3, Ordnance Burn Structure, Site 44, Rocket Motor Pit, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, July.

U.S. Navy, 2000b. Proposed Remedial Action Plan, Site 10, Hideaway Pond, Naval Surface Warfare

Center Dahlgren, Dahlgren, Virginia, July.

U.S. Navy, 2000c. Record of Decision, Site 3, Ordnance Burn Structure, Site 44, Rocket Motor Pit, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

U.S. Navy, 2000d. Record of Decision, Site 10, Hideaway Pond, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

U.S. Navy, 2000e. Federal Facility Agreement Appendix B Site Close-Out Package, AOC X, Classified Incinerator Holding Area, Naval Surface Warfare Center Dahlgren, Virginia, September.

U.S. Navy, 2001a. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 77, Building 1329, Wash Area, Naval Surface Warfare Center Dahlgren, Virginia, July.

U.S. Navy, 2001b. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 61, Paint Can Crusher, Naval Surface Warfare Center Dahlgren, Virginia, September.

U.S. Navy, 2001c. Record of Decision, Site 46, July 28, 1992 Landfill A: Stump Dump Road, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

U.S. Navy, 2001d. Record of Decision, Site 36, Depleted Uranium Mound, Pumpkin Neck and Site 49 Depleted Uranium Gun Butt, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

U.S. Navy, 2002a. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 67, Tar Tank Area, Naval Surface Warfare Center Dahlgren, Virginia, February.

U.S. Navy, 2002b. Federal Facility Agreement Appendix B Site Close-Out Package, Site 59, Octagon Pad Dump, Naval Surface Warfare Center Dahlgren, Virginia, April.

U.S. Navy, 2002c. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 101, Building 155 Auto Shop Waste Oil Filter and UST, Naval Surface Warfare Center Dahlgren, Virginia, April.

U.S. Navy, 2002d. Federal Facility Agreement Priority 1 Site Decision Document, Site 45, July 28 1992 Landfill B, Naval Surface Warfare Center Dahlgren, Virginia, June.

U.S. Navy, 2002e. Federal Facility Agreement Appendix B Site Close-Out Package, AOC Z, Terminal Range Building 109, Naval Surface Warfare Center Dahlgren, Virginia, September.

U.S. Navy, 2002f. Record of Decision, Site 6, Terminal Range Airplane Park, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, September.

U.S. Navy, 2002g. Federal Facility Agreement Priority 1 Site Decision Document, Site 21 Gun Barrel Decoppering Area; Site 22, Gun Barrel Degreasing Area, North Main Range; and Site 53, OWS 207-300, Naval Surface Warfare Center Dahlgren, Virginia, September.

U.S. Navy, 2002h. Federal Facility Agreement Appendix B Site Close-Out Package, Site 41, Compost Area, Naval Surface Warfare Center Dahlgren, Virginia, October.

U.S. Navy, 2003a. Proposed Remedial Action Plan, Site 55, Cooling Pond, Naval Surface Warfare Center Dahlgren, Dahlgren, Virginia, May.

U.S. Navy, 2003b. Federal Facility Agreement Priority 1 Site Decision Document, Site 13, Gambo Creek Truck Wash Area, Naval Surface Warfare Center Dahlgren, Virginia, May.

U.S. Navy, 2004. Federal Facility Agreement Appendix B Site Close-Out Package, SWMU 119, Auto Hobby Used Oil Tank, for the Naval Support Facility Dahlgren, Dahlgren, Virginia, July.

U.S. Navy, 2006. Federal Facility Agreement Appendix B Site Close-Out Package, Site 47a – World War I Munitions Mound and Site 47b – Explosive Ordnance Disposal Scrap Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, November.

U.S. Navy, 2007. Decision Document for Site 1 – Old Bombing Range and Site 5 – Projectile Disposal Area, Naval Support Facility Dahlgren, Dahlgren, Virginia, March.

U.S. Navy, 2007. Success Story at Site 37 – Lead Contamination Site (Shoreline Remediation), Naval Support Facility Dahlgren, Dahlgren, Virginia, May.

APPENDIX A

NORM SITE SCHEDULES

NORM Scheduler - Task Report for:

SITE 00009 (DISPOSAL/BURN AREA) Estimate

Activity:

DAHLGREN VA NSWCTR DIV

Contract Number

Package ID: *951864336*

Package Start: *06/01/1981*

Package Type: *2*

Package End: *02/01/1986*

#	X	Task Name	Start	Dur	End	Code	FY	Planned	Actual
1	S	PHASE 1 PA/SI	06/01/1981		02/01/1986				
2		Norm3 Phase 1 Dates	06/01/1981	1706	02/01/1986				
3	S	PHASE 2 RI/FS	09/01/1988	3619	07/30/1998				
4		Norm3 Phase 2 Dates	09/01/1988	3619	07/30/1998				
5	S	PHASE 3 RD	12/01/1998	165	05/15/1999				
6		Norm3 Phase 3 Dates	12/01/1998	165	05/15/1999				
7	S	PHASE 4 RA	01/10/1999	555	07/18/2000				
8		Norm3 Phase 4 Dates	01/10/1999	555	07/18/2000				
9	S	PHASE 5 IRA		0					
10									
11	S	PHASE 6 LTO		0					
12				0					
13	S	PHASE 7 LTM	08/30/2000	7543	04/25/2021				
14		Historical LTM Phase Dates	08/30/2000	7120	02/27/2020				
15		Award CTO	03/30/2009	394	04/28/2010		9		
16		Award CTO	04/28/2010	365	04/28/2011		10		
17		Award CTO	04/28/2011	365	04/27/2012		11		
18		Award CTO	04/27/2012	365	04/27/2013		12		
19		Award CTO	04/27/2013	365	04/27/2014		13		
20		Award CTO	04/27/2014	365	04/27/2015		14		
21		Award CTO	04/27/2015	365	04/26/2016		15		
22		Award CTO	04/26/2016	365	04/26/2017		16		

23		Award CTO	04/26/2017	365	04/26/2018	17
24		Award CTO	04/26/2018	365	04/26/2019	18
25		Award CTO	04/26/2019	365	04/25/2020	19
26		Award CTO	04/25/2020	365	04/25/2021	20
27	M	Long-Term Management Project Management (Phase				
28	M	Groundwater Sample Analysis - Site Samples (Phase				
29	M	Monitoring Well Installation (Phase 7)				
30	M	Groundwater Sample Collection (Phase 7)				

NORM Scheduler - Task Report for:

SITE 00010 (MERCURY CONTAM HIDEAWAY) Estimate

Activity:

DAHLGREN VA NSWCTR DIV

Contract Number

Package I: *959932517*

Pac: *06/01/1981*

Package Type: *2*

Package End: *02/01/1986*

#	X	Task Name	Start	Dur	End	FY	Planned	Actual
1	S	PHASE 1 PA/SI	06/01/1981		02/01/1986			
2		Norm3 Phase 1 Dates	06/01/1981	1706	02/01/1986			
3	S	PHASE 2 RI/FS	09/01/1988	4040	09/24/1999			
4		Norm3 Phase 2 Dates	09/01/1988	4040	09/24/1999			
5	S	PHASE 3 RD		0				
6				0				
7	S	PHASE 4 RA		0				
8				0				
9	S	PHASE 5 IRA		0				
10				0				
11	S	PHASE 6 LTO		0				
12				0				
13	S	PHASE 7 LTM	10/30/1999	4169	03/30/2011			
14		Historical LTM Phase Dates	10/30/1999	3775	03/01/2010			
15	M	Ecological Sample Collection (Phase 7)						
16	M	Ecological Sample Analysis (Phase 7)						
17	M	Groundwater Sample Analysis - Site Samples (Phase						
18	M	Groundwater Sample Collection (Phase 7)						
19		Award CTO	03/30/2009	365	03/30/2010	9		
20		Award CTO	03/30/2010	365	03/30/2011	10		
21		Award CTO	03/30/2011	0	03/30/2011	11		

NORM Scheduler - Task Report for:

SITE 00012 (CHEMICAL BURN PIT) Estimate

Contract Number

Activity:

DAHLGREN VA NSWCTR DIV

Package ID: *958268953*

Package Start: *06/01/1981*

Package Type: *2*

Package End: *02/01/1986*

#	X	Task Name	Start	Dur	End	FY	Planned	Actual
1	S	PHASE 1 PA/SI	06/01/1981		02/01/1986			
2		Norm1 Phase 1 PA/SI	06/01/1981	1706	02/01/1986			
3	S	PHASE 2 RI/FS	09/01/1988	3255	07/31/1997			
4		Norm2 Phase 2 RI/FS	09/01/1988	3255	07/31/1997			
5	S	PHASE 3 RD	07/31/1997	212	02/28/1998			
6		Norm3 Phase 3 RD	07/31/1997	212	02/28/1998			
7	S	PHASE 4 RA	07/30/1997	213	02/28/1998			
8		Norm4 Phase 4 RA	07/30/1997	213	02/28/1998			
9	S	PHASE 5 IRA		0				
10								
11	S	PHASE 6 LTO	03/31/2001	4442	05/29/2013			
12		Norm6 Phase LTO	03/31/2001	4442	05/29/2013			
13	M	Air/Gas Sample Analysis - Process Samples (Phase	07/31/2007	152	12/30/2007			
14	M	User Defined Cost Model (Phase 6)						
15		Award CTO (Monitor GW)	05/30/2009	365	05/30/2010	9		
16		Award CTO (Monitor GW)	05/30/2010	365	05/30/2011	10		
17		Award CTO (Monitor GW)	05/30/2011	365	05/29/2012	11		
18		Award CTO (Monitor GW - Close-Out Doc.)	05/29/2012	365	05/29/2013	12		
19	S	PHASE 7 LTM						

NORM Scheduler - Task Report for:

SITE 00014 (CW EVAPORATION POND) Estimate

Contract Number

Activity:

DAHLGREN VA NSWCTR DIV

Package ID: *954840338*

Package Type: *2*

Package Start: *01/01/2001*

Package End: *09/30/2008*

#	X	Task Name	Start	Dur	End	Code	FY	Planned	Actual
1	S	PHASE 1 PA/SI	01/01/2001		09/30/2008				
2		Norm3 Phase 1 Dates	01/01/2001	2829	09/30/2008				
3	S	PHASE 2 RI/FS		0					
4				0					
5	S	PHASE 3 RD		0					
6				0					
7	S	PHASE 4 RA		0					
8				0					
9	S	PHASE 5 IRA	12/30/2004	1339	08/30/2008	I-E1			
10		EE/CA Historical	12/30/2004	1276	06/28/2008				
11	M	IRA Construction Project Management (Phase 5)	12/31/2006	608	08/30/2008				
12	S	PHASE 6 LTO		0					
13				0					
14	S	PHASE 7 LTM	07/30/2009	1825	07/29/2014				
15	M	Long-Term Management Project Management (Phase							
16	M	Groundwater Sample Analysis - Site Samples (Phase							
17	M	Monitoring Well Installation (Phase 7)							
18	M	Groundwater Sample Collection (Phase 7)							
19		Award CTO (GW Monitoring)	07/30/2009	365	07/30/2010		9		
20		Award CTO (GW Monitoring)	07/30/2010	365	07/30/2011		10		
21		Award CTO (GW Monitoring)	07/30/2011	365	07/29/2012		11		
22		Award CTO (GW Monitoring)	07/29/2012	365	07/29/2013		12		
23		Award CTO (GW Monitoring)	07/29/2013	365	07/29/2014		13		

NORM Scheduler - Task Report for:

SITE 00015 (SCRAP AREA) Estimate

Contract Number

Activity:

DAHLGREN VA NSWCTR DIV

Package ID: 955190723

Package Type: 2

Package Start: *06/01/1981*

Package End: *09/30/2009*

#	X	Task Name	Start	Dur	End	Code	FY	Planned	Actual
1	S	PHASE 1 PA/SI	06/01/1981		09/30/2009				
2		Norm3 Phase 1 Dates	06/01/1981	10348	09/30/2009				
3	S	PHASE 2 RI/FS		0					
4				0					
5	S	PHASE 3 RD		0					
6				0					
7	S	PHASE 4 RA		0					
8				0					
9	S	PHASE 5 IRA	08/30/2004	1855	09/28/2009	I-E1			
10		Historical Phase IRA Dates	08/30/2004	1855	09/28/2009				
11	M	IRA Construction Project Management (Phase 5)							
12	M	IRA Design (Phase 5)							
13	M	IRA Studies (Phase 5)							
14	M	Off-Site Solid Disposal, Bulk (Phase 4)							
15	M	Excavation of Contaminated Soil/Drums (Phase 4)							
16	M	Solids Sample Analysis - Process Samples (Phase 4)							
17		Soil Removal Action	02/28/2008	0	02/28/2008				
18		Soil Removal Action	02/28/2009	0	02/28/2009		9		
19	S	PHASE 6 LTO		0					
20				0					
21	S	PHASE 7 LTM		0					

NORM Scheduler - Task Report for:

SITE 00017 (OLD SAN LANDFILL) Estimate

Contract Number

Activity:

DAHLGREN VA NSWCTR DIV

Package ID: *951184461*

Package Start: *06/01/1981*

Package Type: *2*

Package End: *02/01/1986*

#	X	Task Name	Start	Dur	End	Code	FY	Planned	Actual
1	S	PHASE 1 PA/SI	06/01/1981		02/01/1986				
2		Norm3 Phase 1 Dates	06/01/1981	1706	02/01/1986				
3	S	PHASE 2 RI/FS	09/01/1988	3693	10/12/1998				
4		Norm3 Phase 2 Dates	09/01/1988	3693	10/12/1998				
5	S	PHASE 3 RD	03/22/1999	210	10/18/1999				
6		Norm3 Phase 3 Dates	03/22/1999	210	10/18/1999				
7	S	PHASE 4 RA	12/01/1999	608	07/31/2001				
8		Norm3 Phase 4 Dates	12/01/1999	608	07/31/2001				
9	S	PHASE 5 IRA		0					
10		Norm3 Phase 5 Dates							
11	S	PHASE 6 LTO		0					
12				0					
13	S	PHASE 7 LTM	10/31/2001	7028	01/27/2021				
14		Historical Phase LTM	10/31/2001	5568	01/28/2017				
15	M	Long-Term Management Project Management (Phase	05/30/2003	5265	10/28/2017				
16	M	Groundwater Sample Analysis - Site Samples (Phase		0					
17	M	Groundwater Sample Collection (Phase 7)		0					
18	M	Groundwater Sample Collection (Phase 7)							
19		Award CTO	01/30/2009	365	01/30/2010		9		
20		Award CTO	01/30/2010	365	01/30/2011		10		
21		Award CTO	01/30/2011	365	01/30/2012		11		
22		Award CTO	01/30/2012	365	01/29/2013		12		
23		Award CTO	01/29/2013	365	01/29/2014		13		

24	Award CTO	01/29/2014	365	01/29/2015	14
25	Award CTO	01/29/2015	365	01/29/2016	15
26	Award CTO	01/29/2016	365	01/28/2017	16
27	Award CTO	01/28/2017	365	01/28/2018	17
28	Award CTO	01/28/2018		01/28/2019	18
29	Award CTO	01/28/2019	365	01/28/2020	19
30	Award CTO	01/28/2020	365	01/27/2021	20

NORM Scheduler - Task Report for:

SITE 00020 (CIRCUIT BOARD EFFLNT TANK) Estimate

Activity:

DAHLGREN VA NSWCTR DIV

Contract Number

Package ID: *958073415*

Package Type: *2*

Package Start: *06/01/1981*

Package End: *05/01/1999*

#	X	Task Name	Start	Dur	End	Code	FY	Planned	Actual
1	S	PHASE 1 PA/SI	06/01/1981		05/01/1999				
2		Norm3 Phase 1 Dates	06/01/1981	6543	05/01/1999				
3	S	PHASE 2 RI/FS	06/30/2002	1857	07/31/2007				
4		Phase 2 Dates	06/30/2002	1857	07/31/2007				
5	S	PHASE 3 RD		0					
6				0					
7	S	PHASE 4 RA	08/01/2007	426	09/30/2008				
8		Historical RA Phase 4 Dates	08/01/2007	393	08/28/2008				
9	M	Construction Project Management (Phase 4)	01/30/2008	184	08/01/2008				
10	M	Off-Site Liquid Disposal, Drums (Phase 4)							
11	M	Off-Site Solid Disposal, Drums (Phase 4)							
12	M	Enhanced Bioremediation (Phase 4)							
13	M	Solids Sample Analysis - Process Samples (Phase 4)							
14		Award CTO (Enhanced Bioremediation)	03/30/2008	0	03/30/2008				
15	M	Mobilization (Phase 4)	04/30/2008	153	09/30/2008				
16	M	Excavation of Contaminated Soil/Drums (Phase 4)							
17	M	Off-Site Solid Disposal, Bulk (Phase 4)							
18	M	Construction Project Management (Phase 4)							
19	S	PHASE 5 IRA		0					
20				0					
21	S	PHASE 6 LTO	07/30/2009	1825	07/29/2014				
22	M	Operations/Maintenance Project Management (Phase							
23	M	Enhanced Bioremediation (Phase 6)							
24	M	Liquid Sample Analysis - Process Samples (Phase 6)							
25		Award CTO	07/30/2009	365	07/30/2010		9		
26		Award CTO	07/30/2010	365	07/30/2011		10		

27		Award CTO	07/30/2011	365	07/29/2012	11
28		Award CTO	07/29/2012		07/29/2013	12
29		Award CTO	07/29/2013	365	07/29/2014	13
30	S	PHASE 7 LTM				

NORM Scheduler - Task Report for:

SITE 00025 (PESTICIDE RINSING) Estimate

Contract Number

Activity:

DAHLGREN VA NSWCTR DIV

Package ID: *958702163*

Package Start: *06/01/1981*

Package Type: *2*

Package End: *02/01/1986*

#	X	Task Name	Start	Dur	End	Code	FY	Planned	Actual
1	S	PHASE 1 PA/SI	06/01/1981		02/01/1986				
2		Norm3 Phase 1 Dates	06/01/1981	1706	02/01/1986				
3	S	PHASE 2 RI/FS	09/01/1988	4041	09/25/1999				
4		Norm3 Phase 2 Dates	09/01/1988	4041	09/25/1999				
5	S	PHASE 3 RD	11/01/1999	354	10/20/2000				
6		Norm3 Phase 3 Dates	11/01/1999	354	10/20/2000				
7	S	PHASE 4 RA	04/01/2001	244	12/01/2001				
8		Historical	04/01/2001	244	12/01/2001				
9	S	PHASE 5 IRA		0					
10									
11	S	PHASE 6 LTO		0					
12				0					
13	S	PHASE 7 LTM	09/29/2002	3469	03/29/2012				
14		Historical LTM Phase Dates	09/29/2002	3438	02/27/2012				
15	M	Long-Term Management Project Management (Phase	09/29/2002	1462	09/30/2006				
16	M	Groundwater Sample Analysis - Site Samples (Phase	09/29/2002	1462	09/30/2006				
17		Award	03/30/2008	365	03/30/2009				
18		Award	03/30/2009	365	03/30/2010		9		
19		Award	03/30/2010	365	03/30/2011		10		
20		Award	03/30/2011	365	03/29/2012		11		

NORM Scheduler - Task Report for:

SITE 00037 (LEAD CONTAMINATED SAND) Estimate

Activity:

DAHLGREN VA NSWCTR DIV

Contract Number

Package ID: *958143536*

Package Start: *04/01/1996*

Package Type: *2*

Package End: *05/01/1998*

#	X	Task Name	Start	Dur	End	Code	FY	Planned	Actual
1	S	PHASE 1 PA/SI	04/01/1996		05/01/1998				
2		Norm3 Phase 1 Dates	04/01/1996	760	05/01/1998				
3	S	PHASE 2 RI/FS	03/31/2002	365	03/31/2003				
4		Historical	03/31/2002	365	03/31/2003				
5	S	PHASE 3 RD	08/30/2003	974	04/30/2006				
6		Remedial Design Historical	08/30/2003	974	04/30/2006				
7	S	PHASE 4 RA	03/30/2005	914	09/30/2007				
8		Historical Award RA	03/30/2005	914	09/30/2007				
9	M	Construction Project Management (Phase 4)							
10	M	Sediment Capping (Phase 4)							
11	S	PHASE 5 IRA		0					
12				0					
13	S	PHASE 6 LTO		0					
14				0					
15	S	PHASE 7 LTM	12/30/2007	4836	03/27/2021				
16	M	Long-Term Management Project Management (Phase							
17	M	RCRA C/Low Permeability Caps (Phase 7)							
18	M	Groundwater Sample Analysis - Site Samples (Phase							
19	M	Monitoring Well Installation (Phase 7)							
20		Award CTO	12/30/2007	365	12/29/2008				
21		Award CTO	03/30/2009	365	03/30/2010		9		
22		Award CTO	03/30/2010	365	03/30/2011		10		
23		Award CTO	03/30/2011	365	03/29/2012		11		
24		Award CTO	03/29/2012	365	03/29/2013		12		
25		Award CTO	03/29/2013	365	03/29/2014		13		

26	Award CTO	03/29/2014	365	03/29/2015	14
27	Award CTO	03/29/2015		03/28/2016	15
28	Award CTO	03/28/2016		03/28/2017	16
29	Award CTO	03/28/2017	365	03/28/2018	17
30	Award CTO	03/28/2018	365	03/28/2019	18
31	Award CTO	03/28/2019	365	03/27/2020	19
32	Award CTO	03/27/2020	365	03/27/2021	20

NORM Scheduler - Task Report for:

SITE 00046 (JULY 1992 LANDFILL A) Estimate

Contract Number

Activity:

DAHLGREN VA NSWCTR DIV

Package ID: *956996172*

Package Type: *2*

Package Start: *04/01/1994*

Package End: *05/01/1996*

#	X	Task Name	Start	Dur	End	Code	FY	Planned	Actual
1	S	PHASE 1 PA/SI	04/01/1994		05/01/1996				
2		Norm3 Phase 1 Dates	04/01/1994	761	05/01/1996				
3	S	PHASE 2 RI/FS	01/29/1999	1067	12/31/2001				
4		Norm3 Phase 2 Dates	01/29/1999	1067	12/31/2001				
5	S	PHASE 3 RD	08/30/2001	220	04/07/2002				
6		Norm3 Phase 3 Dates	08/30/2001	220	04/07/2002				
7	S	PHASE 4 RA	05/08/2002	145	09/30/2002				
8		Historical RA Dates	05/08/2002	145	09/30/2002				
9	S	PHASE 5 IRA		0					
10									
11	S	PHASE 6 LTO		0					
12				0					
13	S	PHASE 7 LTM	10/01/2002	3102	03/30/2011				
14		Historical LTM Phase Dates	10/01/2002	2738	03/31/2010				
15	M	Long-Term Management Project Management (Phase							
16	M	Groundwater Sample Analysis - Site Samples (Phase							
17	M	Groundwater Sample Collection (Phase 7)							
18	M	Monitoring Well Installation (Phase 7)							
19		Award CTO	03/30/2009	365	03/30/2010		9		
20		Award CTO	03/30/2010	365	03/30/2011		10		

NORM Scheduler - Task Report for:

SITE 00050 (FILL AREA NORTHEAST (EEA)) Estimate

Activity:

DAHLGREN VA NSWCTR DIV

Contract Number

Package ID: 956678954

Package Type: 2

Package Start: 04/01/1994

Package End: 09/30/2002

#	X	Task Name	Start	Dur	End	Code	FY	Planned	Actual
1	S	PHASE 1 PA/SI	04/01/1994		09/30/2002				
2		Norm3 Phase 1 Dates	04/01/1994	3104	09/30/2002				
3	S	PHASE 2 RI/FS	02/28/2002	579	09/30/2003				
4		Historical	02/28/2002	579	09/30/2003				
5	S	PHASE 3 RD		0					
6				0					
7	S	PHASE 4 RA		0					
8				0					
9	S	PHASE 5 IRA	03/30/2001	214	10/30/2001	I-E1			
10		Removal Action	03/30/2001	214	10/30/2001				
11	S	PHASE 6 LTO		0					
12				0					
13	S	PHASE 7 LTM	10/30/2003	2343	03/30/2010				
14		Historical Award CTO	10/30/2003	1949	03/01/2009				
15		Award CTO	03/30/2009	365	03/30/2010		9		
16	M	Groundwater Sample Analysis - Site Samples (Phase							
17	M	Groundwater Sample Collection (Phase 7)							

NORM Scheduler - Task Report for:

SITE 00057 (SHELL HOUSE DUMP) Estimate

Contract Number

Activity:

DAHLGREN VA NSWCTR DIV

Package ID: *951596578*

Package Start: *04/01/1996*

Package Type: *2*

Package End: *05/01/1998*

#	X	Task Name	Start	Dur	End	Code	FY	Planned	Actual
1	S	PHASE 1 PA/SI	04/01/1996		05/01/1998				
2		Norm3 Phase 1 Dates	04/01/1996	760	05/01/1998				
3	S	PHASE 2 RI/FS	05/30/2009	750	06/19/2011				
4	M	Phase 2 Studies - Professional Labor (Phase 2)							
5	M	Soil Sample Analysis - Site Samples (Phase 2)							
6	M	Groundwater Sample Analysis - Site Samples (Phase							
7	M	Monitoring Well Installation (Phase 2)							
8	M	Soil Sample Collection (Phase 2)							
9	M	Groundwater Sample Collection (Phase 2)							
10		Award CTO	05/30/2009	750	06/19/2011		9		
11	S	PHASE 3 RD		0					
12				0					
13	S	PHASE 4 RA		0					
14				0					
15	S	PHASE 5 IRA	04/30/2010	220	12/06/2010	I-E1			
16	M	IRA Construction Project Management (Phase 5)							
17	M	Demobilization (Phase 4)							
18	M	Mobilization (Phase 4)							
19	M	Off-Site Solid Disposal, Bulk (Phase 4)							
20	M	Excavation of Contaminated Soil/Drums (Phase 4)							
21	M	Solids Sample Analysis - Process Samples (Phase 4)							
22		Award DO	04/30/2010	220	12/06/2010		10		
23	S	PHASE 6 LTO		0					
24				0					
25	S	PHASE 7 LTM		0					
26				0					

APPENDIX B

DRAWINGS

May 22, 2003 1:20:08 p.m.
Drawing: P:\CADD\DAHLGREN\TAG_BASE.DWG

DRAWN BY LR DATE 6/07	Tetra Tech NUS, Inc.	CONTRACT NO. N62477-03-D-0163 / OWNER NO. 004
CHECKED BY DP DATE 6/07	Unit Location Map at Mainside Naval Support Facility Dahlgren Dahlgren, Virginia	APPROVED BY / DATE
COST/SCHED-AREA		APPROVED BY / DATE
SCALE 0 500 1000 SCALE IN FEET		DRAWING NO. Drawing 1 / REV. 2

NAVFAC Naval Facilities Engineering Command
NAVFAC WASHINGTON

Legend

32 Site Location	Parking Areas
Buildings	Streams
Roads	Open Water
Railroads	Marsh

Naval Facilities Engineering Command
NAVFAC WASHINGTON

DRAWN BY LR — DATE 6/08	Tetra Tech NUS, Inc.	CONTRACT NO. N62477-03-D-0163	OWNER NO. 004
CHECKED BY MM — DATE 6/08	Unit Location Map at EEA Naval Support Facility Dahlgren Dahlgren, Virginia	APPROVED BY — DATE	
COST/SCHED-AREA		APPROVED BY — DATE	
SCALE 0 500 1000 SCALE IN FEET		DRAWING NO. Drawing 2	REV. 2

Doc# 0715
EPA# 5.02

DECISION DOCUMENT FOR
NO ACTION OR DEFERRAL OF ACTION AT
SITE 1 - OLD BOMBING RANGE AND SITE 5 - PROJECTILE DISPOSAL AREA
NAVAL SUPPORT ACTIVITY
DAHLGREN, VA

This decision document is prepared by the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command Washington (NAVFAC Washington), with the assistance of the Environmental Protection Agency (EPA) Region III, and the Commonwealth of Virginia Department of Environmental Quality (VDEQ), pursuant to the provisions of the Federal Facility Agreement (FFA) (EPA Docket No.III-FCA-CERC-008) for Naval Support Facility (NSF) Dahlgren, therein referred to as the Naval Surface Warfare Center (NSWC) Dahlgren Division, in Dahlgren, Virginia. The document addresses two initial assessment study (IAS) sites (Site 1 and Site 5) in the FFA, as more particularly described below, and recommends deferral of potential action based on the location of both sites within the boundaries of operational military testing ranges.

IAS Site 1, identified as "AOC J" and referred to as the "Old Bombing Range" in Appendix A of the NSF Dahlgren FFA, is located within the boundaries of the Missile Test Range in the central part of Mainside in NSF Dahlgren. The site is approximately 293 acres in size, and is currently wooded and vegetated. Attachment 1 represents the boundaries of Site 1. The site was more actively used in the early 1940s as an aerial bombing range.

IAS Site 5, identified as "SSA #51" and referred to as the "Projectile Disposal Area" in Appendix A of the NSF Dahlgren FFA, is located within the boundaries of the Terminal Range, north of Building 934 at NSF Dahlgren. Site 5 was included in the FFA based on the verbal report of potential disposal of projectiles. No specific disposal location was indicated, just a general description of an area on Terminal Range. A review of historical aerial photographs indicates the potential location of Site 5 (see Attachment 2). The site is approximately 2.53 acres in size, and mostly vegetated with grass, except in areas previously developed or disturbed. The site is reported to have been a wetland filled in with construction rubble, projectiles, fill dirt and ordnance probably coming from others areas on the range. Disposal reportedly occurred during the late 1930s or early 1940s.

Because both sites are located within the boundaries of operational military ranges, it is the consensus of the Navy, EPA, and VDEQ Remedial Project Managers that these sites require no action under the NSF Dahlgren FFA. Due to constraints on the Navy's Environmental Restoration (ER,N) program, ER,N funds are not authorized for cleanup actions at these operational ranges, as provided in the document entitled Department of the Navy Environmental

Restoration Program Manual, Section 4.2.1, Response Eligibility Criteria, pages 4-7. Any necessary cleanup of sites within operational ranges is conducted pursuant to applicable laws and regulations upon any subsequent closure or transfer of the relevant range, as provided in the document entitled DoD and EPA Interim Final Management Principles for Implementing Response Actions at Closed, Transferring, and Transferred Ranges, dated 7 March 2000. Based on this decision, potential action at both sites is deferred until the ranges are closed or transferred.

The location of Sites 1 and 5 will remain marked on the installation's geographical information system (GIS) in order to prevent incompatible land uses, other than range operations. Any changes in land use will be evaluated and approved for inclusion in the installation's Regional Shore Infrastructure Plan (RSIP), which documents current and anticipated land uses within the installation. The NSWC Commander in charge of the ranges has been notified of this document and concurs with its decision.

This decision shall be effective upon signature of the NSF Dahlgren Commanding Officer and the Remedial Project Managers. The document may be amended or rescinded by the parties pursuant to the FFA if deemed necessary to protect human health and the environment.

APPROVAL BY:

Bruce C Beach 9/10/2007
Bruce Beach
Remedial Project Manager
U.S. EPA Region III

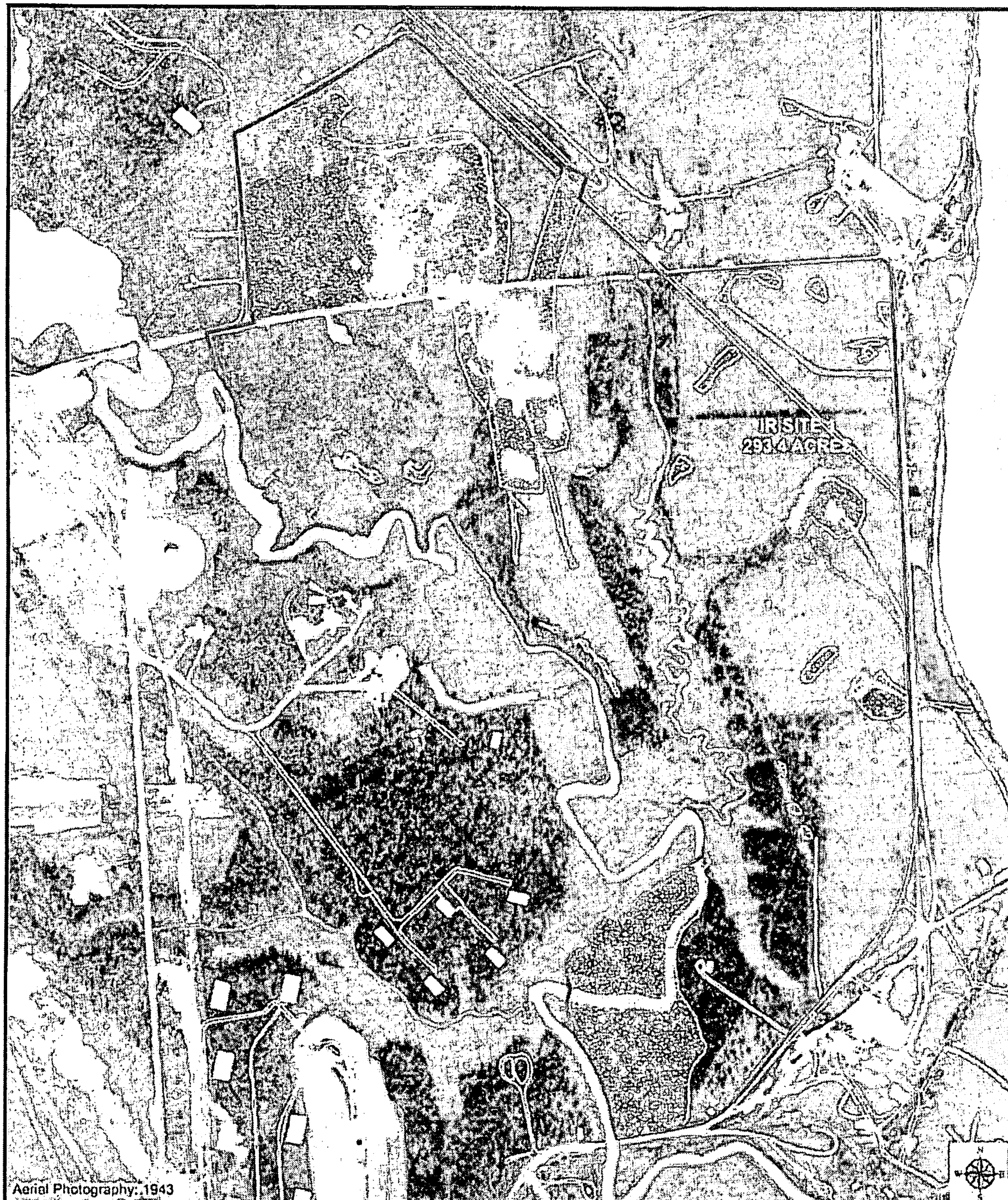
Karen M Doran 9-25-07
Karen Doran
Remedial Project Manager
Virginia Department of Environmental Quality

Ryan Mayer 9/26/07
Ryan Mayer
Remedial Project Manager
NAVFAC Washington

9/27/07
James R. Pinto
Installation Restoration Program Manager (Acting)
Naval Support Facility - Dahlgren

CONCURRENCE BY:

J L Smith 9-27-07
J.L. Smith, CAPT USN
~~Installation~~ 9?? Commanding Officer
Naval Support Activity
South Potomac



Legend

Buildings
Roads
Water Bodies
IR Site 1
Potential Bombing Impact Area

0 262.5 525 1,050 1,575 2,100 Feet

Naval Support Facility, Dahlgren
IR Site 1
Old Bombing Range

EHSITIRP-2007-002
FEBRUARY 15, 2007

Legend

Buildings IR Site 5

Roads

0 35 70 140 210 280 Feet

Naval Support Facility, Dahlgren
IR Site 5
Projectile Disposal Area
EHSITIRP-2007-001
FEBRUARY 15, 2007

Doc#0715
EPA# 5.02